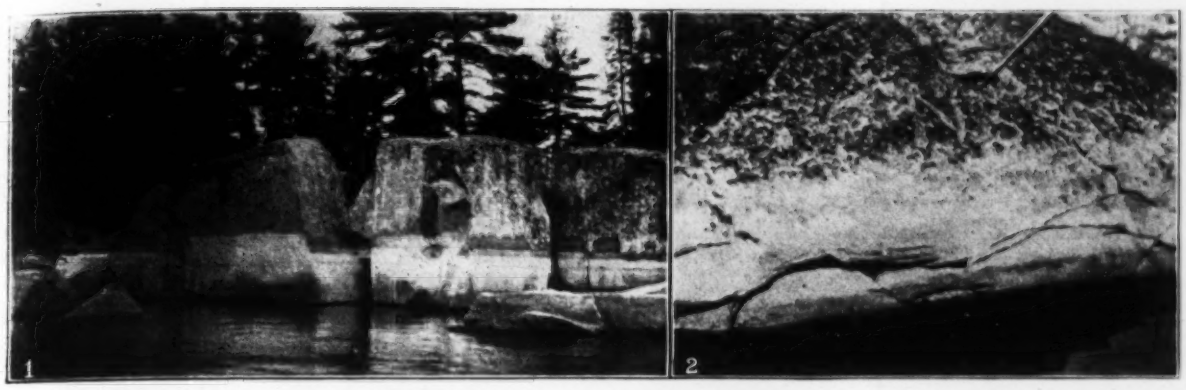


WATER STAINS OR MARKS ON ROCKS ALONG SHORE, LAKE-OF-THE-WOODS
1—Clearly defined marks. 2—Illustrating time required for growths to efface mark

Moss and lichens, common vegetation in northern latitudes, played an important part, the water stains on rocks along the shore being due to the absence or partial absence of one or more forms of these lichens.

It was found that removal of these lichens and the formation of a water mark by standing water might be effected in a comparatively short time, possibly a season, but a number of years were required to substantially change the sharpness of a water line once formed.

These stains, or water marks, are shown in Fig. 1, the marks being higher on the exposed face than around the corner where protected from wave action. The length of time required to alter a mark is illustrated in Fig. 2, where the high-water mark was cut in the rock in 1895.

Fishing for 60-Ft. Girders Washed Out in Flood

By Ernest D. Clabaugh*

A January flood in Southern California played havoc with a bridge of the Atchison, Topeka & Santa Fe Ry., over the Santa Ana, between Richfield and Olive. On the north side 300 ft. of embankment was washed out, on the south side 400 ft. Ten bents were taken out and numerous scattered piles of the trestle, as were also four 60-ft. steel-girder spans and four concrete piers. Three of the spans have been located, but the fourth has entirely disappeared. Two were sticking above the sand, as illustrated in Figs. 1 and 2, while the third was discovered by kicking it while wading in the river.

In repairing the bridge a temporary pile trestle was built out from where the embankment had been and along the former site of the girders. This trestle consisted of five-pile bents spaced 14 ft. c. to c. and of two 4-ply chords. The piles were driven to refusal, the average penetration being 28 ft. The projection above ground was 8 ft., giving a pile length below cutoff of 36 ft.

During piledriving two of the concrete piers were encountered. These were found to be at depths of 14 and 17 ft. below the surface of the sand. The piers were definitely located by means of a water jet and were found to be turned over on their sides, having fallen slightly upstream. One pier had been left standing by the flood, and resting against this and in line with the track was one of the spans with one end sticking down into the sand a distance of 28 ft. (Fig. 2).

*Bridge Inspector, Atchison, Topeka & Santa Fe Ry., 115 So. Olive St., Anaheim, Calif.

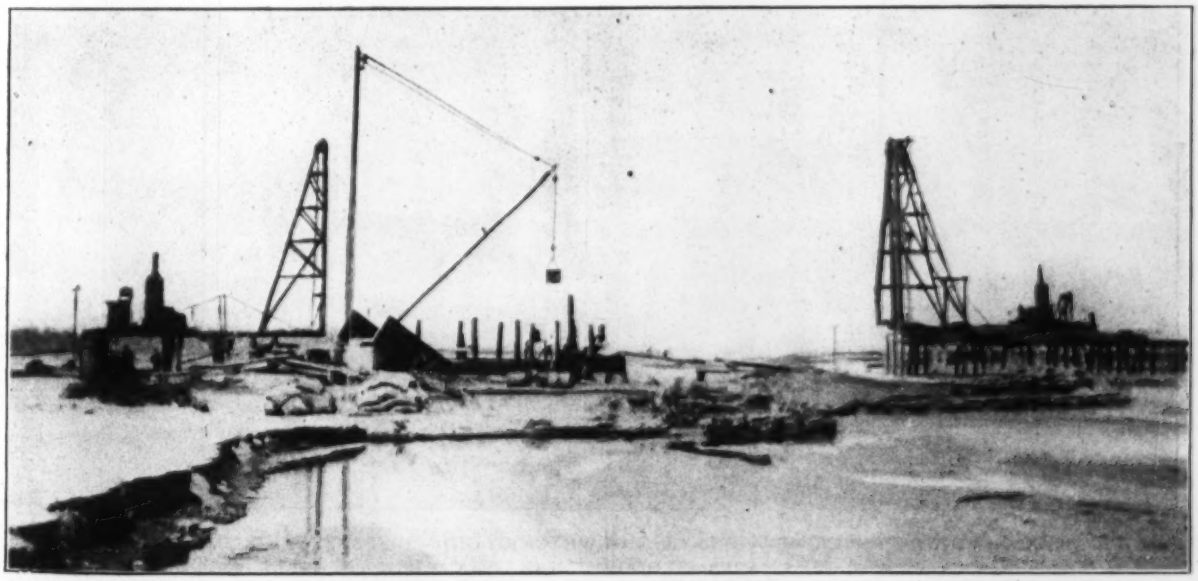


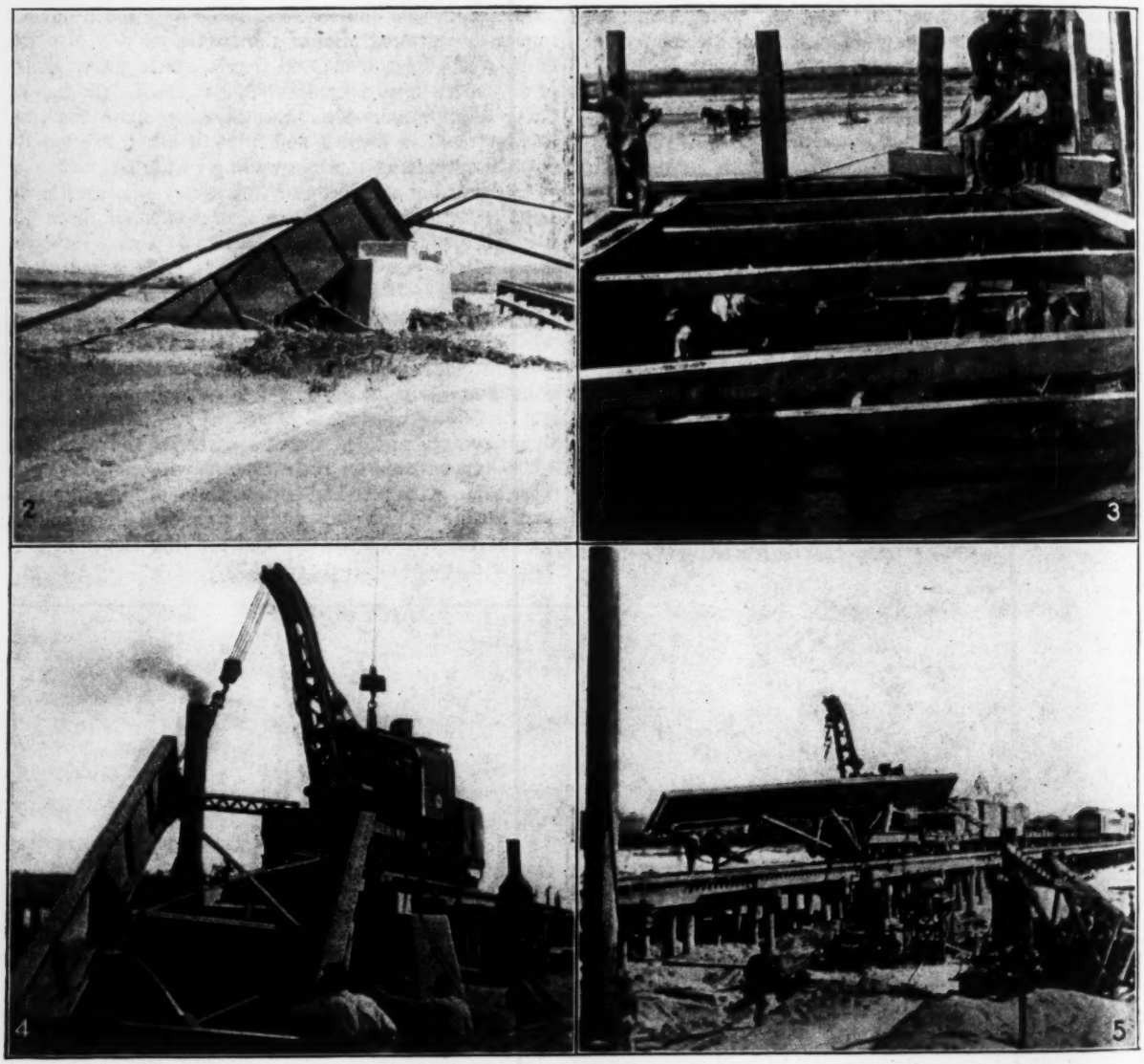
FIG. 1. EXCAVATING FOR GIRDER SPAN; PILEDRIVERS WORKING AT BOTH ENDS OF TRESTLE

This span had to be removed in order to extend the trestle, and this operation was accomplished by sinking a timber coffer-dam inclosing the girder. The sand was excavated from inside by a time-consuming method made necessary by the accumulation of débris and bridge ties that had collected about the girder, making it impossible to use a clamshell bucket. All the dirt had to be shoveled into boxes, which were raised by a derrick (Fig. 1) and dumped to one side of the coffer-dam.

Water in the river was diverted from around the girders by means of a sandbag levee. To remove the water from the inside of the coffer-dam two 8-in. centrifugal pumps had to work continuously. At 20-ft. depth these pumps could barely keep up with the inflowing water. At this depth a 50-ton wrecking train pulled the girder the remaining distance out of the sand. As long as the span was intact the wrecker could only shake it. The sides were parted by an oxyhydrogen flame; then by alternately raising and lowering the ends of each girder, the two were readily removed, one at a time. As soon as the span was out of the way the gap was closed and traffic resumed.

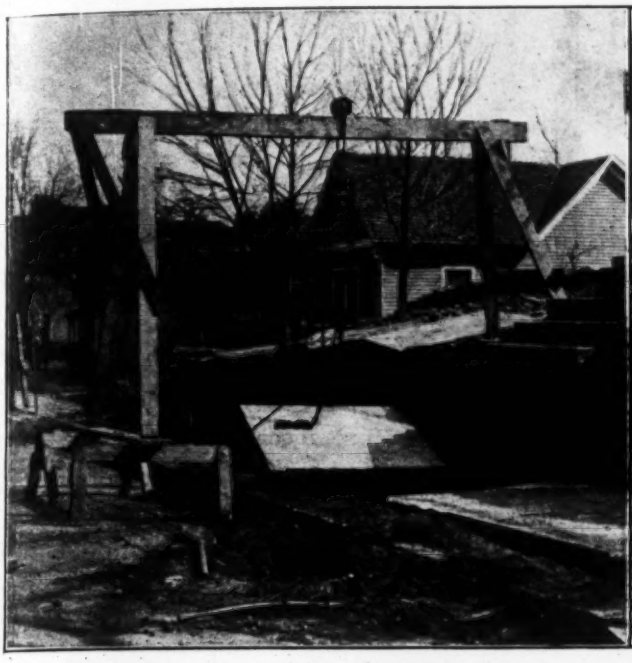
The other spans will be exhumed as soon as the water in the river lowers sufficiently to make pumping practicable. These spans lie almost parallel to and 3 or 4 ft. below the surface of the ground and their removal will not present unusual difficulty.

This washout stopped traffic on this line from the latter part of January until the end of April, but this did not seriously interfere with the business of the railway as the line was used primarily as a cut-off for freight traffic between San Bernardino and San Diego and this business was readily diverted through Fullerton, the haul being lengthened by about 10 mi.



FIGS. 2 TO 5. VIEWS SHOWING HOW ONE OF THE WRECKED GIRDER SPANS WAS RECLAIMED ON THE SANTA FE BRIDGE IN OLIVE, CALIF.

Fig. 2—Steel girder spans 60 ft. long, almost buried in sand. Fig. 3—Coffer-dam inclosing girder span. Fig. 4—Recovering span, using wrecking train. Fig. 5—Taking girder ashore on wrecking train



LOWERING SLABS OF FORMER SIDEWALK

SIDEWALK RELAID AT NEW GRADE

Lowering Concrete Sidewalk to New Grade

Last summer, after a number of streets in Dyersburg, Tenn., had been improved, it was found that the concrete sidewalks would either have to be rebuilt or lowered to new grade. In view of their excellent condition it was decided to lower them. The following costs are for a typical section of this work:

Lineal feet of sidewalk	74 ft.
Width of sidewalk	5 ft.
Cost of labor	$26.40
Cement: 8 sacks at 60c	4.80
Sand: ¼ yd. at $3	.75
Sand: ¾ yd. at $1.40	1.05
Total cost	$33.00

Excavation on this section amounted to 18 cu.yd. and the cost of lowering to 8.8c. per sq.ft. The sidewalk in Dyersburg is laid by contract at 12½c. per sq.ft.—1:2 (limestone screenings) for ¾-in. top; 1:3:5 for 3¼-in. base. The saving accomplished by lowering instead of rebuilding therefore amounted to 3.7c. per sq.ft. The contractor has agreed to lower sidewalks in the future for 8c. per sq.ft.

Bridge Piers in Sumatra

By J. W. Swaren*

The geological formation of the island of Sumatra is volcanic and its streams have no gravel. There is, however, plenty of sand. As a usual thing, the roads are little more than trails, with only the deeper streams crossed by bridges. Recently, a hydroelectric plant was installed in the interior, and it was necessary to build a road wide enough to accommodate bullock trucks, and bridges of sufficient strength to bear up the heaviest parts of Pelton wheels. Timber stringers set on distinctly Sumatran piers were used. The cement for these piers was transported in sacks carried on the heads of the natives.

*Hayward, Calif.

Arriving at the site, an approximate 1:4 mixture of dry cement and dry river sand was hand mixed. The mixture was then shoveled dry into empty burlap bags, and these were piled sandbag fashion in the stream, as shown in the photograph. The first tropical rain that came along was supposed to complete the concrete.

In the far interior, some of the natives looked on these bridges as traps set by the white men and still clung

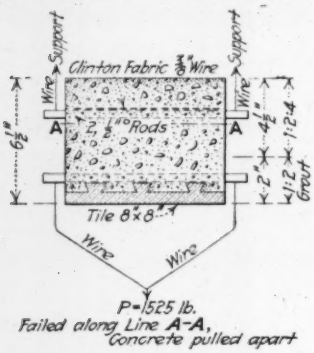
SUMATRAN BRIDGE PIERS BUILT OF BAGS OF 1:4 CEMENT AND SAND

to the use of their fords. However, the more daring spirits mustered up sufficient courage to cross these diabolical contrivances, and their example was soon followed by the more timid.

Test of Adhesion of Face Tile to Concrete Backing

Vitrified clay tile are used as smoke and blast protection for the concrete encasement of the Boston & Albany R.R. crossing over the New York, New Haven & Hartford R.R. tracks at Worcester, Mass. A test was made

to determine the gripping effect between tile and concrete. Very satisfactory adhesion strength was found; in fact the strength of the grip exceeded the strength of 9-day-old concrete. The following particulars are given by F. B. Freeman, Chief Engineer of the Boston & Albany R.R. The top of the locomotive stacks comes within 3 ft. of the under surface of the bridge. The tile selected for these conditions was burned specially hard, almost to vitrification. To prevent excessive warping in the burning, the size was made small, 8x8 in. The tile is 1 in. thick, and has on the back three longitudinal dovetail ribs 1⅜ in. wide on top, 1⅛ in. wide at the neck and ½ in. high.



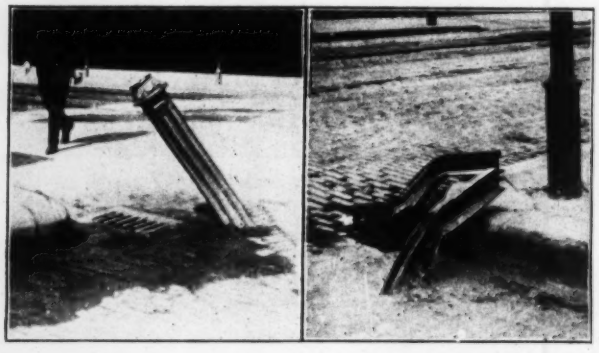
TEST OF BLAST-PROTECTION TILE FOR BOND TO CONCRETE

The test block of concrete was made 6½ in. high, with 1:2 mortar in the lower inch (2 in. from face of tile), and 1:2:4 concrete for the 4½ in. above this. After 9 days' hardening the test was made in the way shown by the sketch. The average of the strengths obtained in several tests was 1,525 lb.

The rods of which load was applied were molded in the specimen, and probably had a certain amount of support from the concrete itself. However, if a well-marked plane of weakness existed at contact of tile and concrete, embedment of the rods would not delay the splitting away of the tile very long.

NOTES

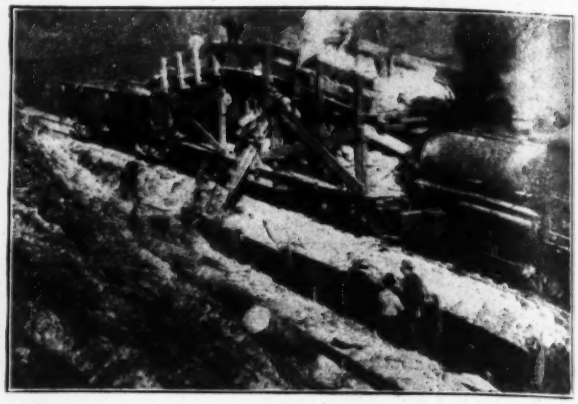
Catchbasin Inlet Protectors are shown in the accompanying illustrations. They are examples of the practice of the Galveston, Tex., street commissioner. The sidewalk curbs are practically sharp cornered (not over 2-ft. radius); and the catchbasin inlet is either in the street, as the first view shows,



CATCHBASIN INLET PROTECTORS, GALVESTON, TEX.

or at the point of intersection, as in the second view. The street authorities are evidently inclined to protect the inlets and curb corners at any cost. Not all the curb corners in the business section of Galveston are thus "armored."

A Concreting Train for Building a Retaining Wall was devised by G. C. Earl, Assistant Division Engineer of the Bingham & Garfield R.R. This railway winds around and among the Utah Copper Co.'s immense mines at Bingham, Utah, and



CONCRETING TRAIN; UTAH COPPER CO., BINGHAM, UTAH

is used primarily to bring ore from the various benches or berms (where it is excavated by steam shovel) to the concentrating plant at Garfield. The railway climbs the mountain sides on 4% grades by means of switchbacks, so that the tracks are often but a short distance apart horizontally, separated by steep slopes. Between two such laps, or levels of track, it was recently necessary to construct a retaining wall, and the view shown illustrates the construction method and plant. On account of the track above (not shown) a permanent plant could not be placed on the uphill side, so a movable plant was designed to work from one of the main tracks of the lower level. When necessary, this outfit can be moved to a siding to permit train operation. The plant consists of a locomotive, a flat-car with an overhead bridge, a 10-cu.ft. concrete mixer and a gondola car for gravel. A half day's supply of cement is kept on the mixer car. A track and a 4-wheeled skip bring the gravel from the gondola to the mixer hopper. The track is laid on the bridge incline and on top of the gravel in the gondola, until it is necessary to support it on horses as the car is emptied. To bring the skip up the incline, a hoist is provided below, alongside the mixer. Both mixer and hoist are operated by steam from the locomotive. The mixer is charged from the overhead bridge and discharges into a chute which carries the concrete to the forms. The bridge car is reversible and can be coupled to either end of the gondola. The capacity of the plant averages 125 yd. per day.

Costs to Build Spur Tracks are given in a recent issue of "Power." A 778-ft. spur, including a 1,660-ft. trestle, cost $6,121. Spurs built entirely on the surface cost from $1.30 to $2.40 per mi. Following are the items for spurs of different lengths. The work was in Massachusetts:

SPUR TRACK; LENGTH, 562 FT.

Ballast	73 cu.yd.	@	$0.75	$55
Ties	281	@	.52	146
Rail, 56-lb. T	9.32 tons	@	28.54	266
Joints	24	@	.62	15
Split switch and frog				75
Spikes	3.3 kegs	@	4.10	13
Tracklaying	562 ft.	@	.25	140
Teaming on track material	12 tons	@	1.25	15
Total				$725

SPUR TRACK; LENGTH, 693 FT.

Grading, earth	682 cu.yd.	@	$0.30	$205
Ballast, cinder	234 cu.yd.	@	.25	58
Ties	304	@	.51	155
Rail, 60-lb. T	10.79 tons	@	28.54	308
Joints	60	@	.65	39
Spikes	4 kegs	@	4.10	16
Switches and frogs				202
Tracklaying	693 ft.	@	.25	173
Teaming on track material	17 tons	@	1.25	21
Total				$1,177

TRESTLE AND SPUR; LENGTH, 778 FT.
(Construction: Timber on Concrete Piers. Trestle About 160 Ft. Long)

Excavation	202 cu.yd.	@	$0.50	$101
Concrete in piers and abutments	208.5 cu.yd.	@	5.75	1,199
Timber in trestle, including ties on trestle	40 M bd. ft.	@	60.00	2,400
Ellis bumper (1)				70
Ladder (1)				4
Earth-filling	4,200 cu.yd.	@	.31	1,302
Ties	314	@	.59	185
Rails, 75-lb. T (laying)	778 ft. track	@	.25	194
Rails, 75-lb. T	17.36 tons	@	30.63	532
Joints, continuous	52	@	1.64	85
Spikes	4.1 kegs	@	4.10	17
Teaming on track material	26 tons	@	1.25	32
Total				$6,121

Editorials

Safety for Workmen's Eyes

The widespread "Safety First" movement, which has had such a wonderful effect in the railway service and in industrial establishments in reducing the number of accidents to workmen, is receiving attention also in engineering-construction work. It is much more difficult to train the shifting force of workmen employed on the average construction contract to observe safety rules than it is to educate the more permanent employees who work on a railway or in a machine shop. The engineer who wishes to reduce accidents to those working under him, therefore, usually gives chief attention to guarding machinery and to safe handling of explosives.

It seems worth while to call attention to one simple safety appliance that ought to be much more generally used on construction work, and that is goggles for the protection of the eyes where men are engaged in chipping stone or metal or in other work where the eyes are likely to be struck by flying particles. In a special bulletin on "Industrial Accident Prevention," issued by the New York Department of Labor, several pages are devoted to protection of the eyes. It is fortunate that the wide use of automobile goggles makes it possible to obtain for workmen almost anywhere now, at a trifling sum, eye-protecting apparatus that is generally entirely satisfactory. Not only this, but the custom of wearing goggles, which the automobile has established, has gone a long way toward eliminating the prejudice against their use and made it much easier to induce workmen to wear them.

Creeping and Heaving of Concrete-Road Slabs

Sufficient experience has accumulated in concrete-road construction so that most concrete roads as now built have a hard and durable surface capable of resisting the wear of traffic. Difficulties are being experienced, however, especially in northern latitudes, with the rising up of one slab above another at transverse joints and also with the gradual widening of longitudinal cracks.

In concrete roads built south of the latitude of New York little trouble seems to be experienced with cracking. The generally adopted plan of filling a crack with melted tar and covering it with sand appears to make the road as good as new, involves little expense and appears to be unobjectionable, except on the possible ground of the appearance of the pavement.

In roads located farther north, however, there are cases where longitudinal cracks in a concrete road have given much more trouble. In certain cases the crack gradually widens until sometimes the two sides are separated as much as two or three inches. Trouble has been experienced occasionally also with the slabs on the two sides of a longitudinal crack getting out of level. A concrete road in North Andover, Mass., was so heaved by the frost last winter that the concrete on one side of a crack through the center was 2 in. higher than on the other. When the frost came out of the ground, the slabs settled back to place; but the cracks which were originally hair cracks were widened to about ½ in. in some places. The cause of this movement on this particular road, and probably on most roads where trouble has been experienced, is poor drainage of the subgrade. In any climate where the frost penetrates deeply, if the subgrade is saturated with water, there is bound to be considerable upward movement as the ground freezes; and if one side of the road is wetter than the other, the heaving will be unequal.

Every road engineer of long experience knows that in constructing all of the older kinds of highways, from dirt roads to macadam, good drainage is the first essential to success. Possibly some engineers may have had the idea that, because a concrete road forms a tight roof over the subgrade and distributes the load equally over it, thorough drainage is less necessary. The experience previously mentioned indicates that it is well worth while to take pains with drainage where a concrete road is to be built.

There are, however, engineers who are fearful of the results from longitudinal cracking in a concrete road even with the drainage thoroughly taken care of. It was doubtless this feeling on the part of many engineers that led to the recommendation by the Concrete Road Conference, last February, that on concrete roads 20 ft. or more in width reinforcement should be embedded to prevent longitudinal cracking. There is controversy, however, as to how much reinforcement is necessary to make a road safe against cracks and as to whether the reinforcement will not be broken if a crack does occur, so that it will not prevent the gradual separation of the slabs.

Where such separation happens, it is evident that the slabs creep on the subgrade. Such creeping has been known to take place even when the subgrade was made entirely flat. Probably the water percolating into and freezing in the central crack is sufficient to account for this movement.

A plan has been suggested and is under consideration for adoption on an important road some five miles in length in the vicinity of New York City to obviate the risk of trouble from the creeping of slabs and thoroughly bond them to the subgrade. The road in question runs through a traprock district where good material for a telford base is obtainable at nominal cost. It is proposed after completing and rolling the subgrade to place upon it a layer of telford stone, exactly as would be done for building an ordinary macadam road. This telford will be filled with spalls and compacted with a steam roller. The telford stone will in this way be thoroughly bonded with the subgrade. It is proposed to fill the voids in this layer of telford with portland-cement grout and then lay on top of it, before the grout begins to set, a layer of concrete 3 to 4 in. thick. If made in this way,

the concrete top should be perfectly monolithic with the telford stone underneath. The whole, in fact, would form a layer of concrete 10 to 12 in. in thickness. The under surface of this concrete would be so thoroughly bonded to the subgrade that no creeping movement would be possible. Apparently the cost of constructing a road in this way should be little if any more than the cost of constructing the ordinary single-course concrete road. The telford base should be laid and grouted for about 55 to 60c. per sq.yd., and 50c. to 60c. per sq.yd. should be sufficient to cover the cost of the top layer of concrete.

This type of concrete-road construction might have notable advantages where there is available plenty of local stone that is too soft to stand wear. This stone could be used for the telford layer, reducing by one-half the amount of hard stone or gravel necessary to ship in for the finishing concrete. It would have the advantage, moreover, of giving a better bond between the subgrade and the concrete, and between the upper and lower courses, than is apt to be obtained in the ordinary two-course construction.

It is worth consideration, moreover, whether this type of construction would not be especially advantageous where a concrete road is built without transverse joints, as is being practiced now by a number of road engineers. It seems reasonable to believe that with the thorough bonding to the subgrade, which would take place in this construction, the contraction due to temperature or moisture changes would be so distributed over the road that the tendency to cracking might be greatly reduced.

We commend the suggestion to engineers interested in concrete-road construction and shall be pleased to receive any criticisms or suggestions in connection with it.

Do Elevated Railways Need the Block System?

The rear collision on the Manhattan Elevated Ry. on June 8, in which the motorman of a train was killed and a number of passengers were injured, has revived public agitation to have the block system adopted on the elevated lines. There is practically no disagreement from the proposition that the block system, in some form or other, is the only reasonably safe method of operating trains in general railway service. Under the special conditions of elevated railway service, however, the remarkable record of safe train movement under densely crowded traffic, which has been shown on the Manhattan elevated lines for many years, demonstrates beyond question that it is possible to operate such railways with a marvellously high degree of safety without the use of the block system. It is stated that in the nine years since 1907 the elevated railway lines of New York City have carried over 3,000,000,000 passengers of whom only five have been killed in train accidents.

The collision on June 8 would hardly have been prevented had a block system been in force. The motorman who met his death as a result of the accident ran his train in broad daylight into a standing train of empty cars, which he approached on a long stretch of straight track. Since some defect in his mental machinery prevented him from stopping his train with the brake power under his hand, although his error cost him his life, it is fair to conclude that he would have been no more likely to stop had a semaphore arm beside the track stood at danger.

The motorman did this moreover, it is to be noted, in disregard of a rule that the first car of a train must not run alongside a station platform until the last car of the preceding train has passed the opposite end of the platform. At present during the rush hours, the trains on the heaviest traffic lines of the Manhattan elevated are run under as low a headway as 38 sec. It would be possible, of course, to install upon the elevated lines automatic stop devices such as have been put into use on the express lines in the subway. Such automatic stop devices, although they have never been developed to a point where they have commended themselves for use on railway lines of general traffic, are entirely practicable for roads operated under such conditions as the subway or the elevated lines. If such automatic stops were installed on the elevated, however, it would obviously necessitate an increase in the spacing between trains, and corresponding reduction in traffic capacity. With the slow speeds and regular stops in force on the elevated, and the record of safety which past experience has shown, it would be difficult to demonstrate any material gain in safety through the installation of automatic stops.

Safe Railway-Bridge Floors

A railway-bridge floor illustrated and described in our issue of June 8, page 1095, appears to call for some comment in this place. We published this article, as we publish many articles, as a matter of news and information, regardless of whether the design conformed to the opinions of the editors or not.

The particular feature of this floor was the omission of inside guard rails, and according to the statement furnished us, this construction had been used for some years with satisfactory results and derailed wheels had been guided safely across the bridge. Without questioning this statement, we wish here to give the strongest possible emphasis to the statement that on all railway bridges over which passenger trains run at ordinary speed a bridge floor should be furnished with both inside guard rails and outside guard timbers.

More than 25 years ago two terrible railway-bridge disasters—one occurring at White River on the Central Vermont Ry. in 1887, the other at St. George, Ont., on the Grand Trunk Ry. in 1889—called the attention of railway-bridge engineers the country over to the need of better railway-bridge floors and had unquestionably an enormous influence in improving practice.

Most railway engineers know perfectly well the reasons that make the use of both inside guard rails and outside guard timbers advisable. It may be well to point out here, however, for the benefit of some of the younger men in the profession that the inside guard rail tends to keep the wheels of a derailed truck in line by guiding the back of the wheel and will in most cases hold the truck in line and keep the wheel from striking the outside guard timber. Where, however, inside guard rails are omitted, if a pair of derailed wheels swerve from a straight line until they strike the timber guard rail, there is great danger that they will cut into and mount this timber instead of sliding along it. This is particularly apt to be the case, because, when the leading wheel strikes the timber, the resistance is interposed at a point that

tends very strongly to slew the truck farther out of line, whereas the resistance imposed by the inside guard rail tends to bring the truck back into line.

If there were any large expense involved in placing inside guard rails on a bridge floor, those who attempt to economize by omitting them might have some small basis for defense; but every railway company, even those forced to practice the greatest economy, always has worn rails which can be used at a cost no greater than their value for scrap. The best practice, of course, would call for an inside guard rail as heavy as the track rail; but if extreme economy is imperative, a railway may use old rails for its bridge guard rails and escape censure in case of accident. It cannot do this if it omits inside guard rails entirely.

A pertinent illustration of what has been just said is the recent wreck of a passenger train on the Rock Island road in which 13 people were killed, reported on page 1200 of this issue. It is true that the bridge where the accident occurred was in bad shape because of a flood, but the engine, tender and first two cars crossed in safety and the first car derailed was the smoker. One truck of this car appears to have so bunched the ties that the following car went into the river. It is probable that inside guard rails might have kept this truck in line and saved the train.

A One Hundred Million Dollar Debate

No more remarkable meeting has ever been held in the auditorium of the Engineering Societies' Building in New York City, than that which has been daily assembled there from June 1 to June 15. On one side of a long table extending entirely across the stage were seated a dozen or more men, heads of the railway trainmen's unions which have served a demand on the railway companies of the United States for the establishment of the eight-hour day. Seated on the opposite side of this table were a score of railway officials, the authorized representatives of the railway companies. An audience of 500 to 800 men filled the auditorium, representatives of the local lodges of engineers, firemen, conductors, brakemen, etc., listening to the debate in progress on the stage with a close attention that one seldom sees displayed by an audience in this auditorium or any other.

It is safe to say that this discussion, involving as it does nearly half a million employees and an annual outlay estimated at $100,000,000, is the most gigantic example of "collective bargaining" that has ever been seen in the world. It is much to be regretted that after two weeks of discussion and endeavor to reach a common understanding the conference was ended without agreement.

The railways submitted a tentative offer to grant the trainmen's demand for an eight-hour day, provided that in connection with the demand a general investigation and revision of existing rates of wages should be undertaken with a view to modification according to the following principles: (a) No double compensation to be paid for the same time or service; (b) the same classification for purposes of compensation to be applied to all members of a train and engine crew. The trainmen's representatives, however, refused to accept this.

The conference was adjourned to be reassembled again after the railway unions have taken a vote on the proposition which will be laid before them by their leaders. The final proposition of the chairman of the railway representatives, Elisha Lee, was that the matters in controversy should be referred for decision to some disinterested tribunal for investigation and decision, preferably the Interstate Commerce Commission, or else to arbitration in accordance with the provisions of the Newlands act.

A. B. Garretson, representing the Order of Railway Conductors and chairman of the committee representing the unions, in declining this proposal declared that the Interstate Commerce Commission was a rate-fixing body and had no legal authority to fix rates of wages. Concerning arbitration he declared that the sentiment of the employees was against it and that "until a condition has arisen that may threaten the interruption of traffic, I and the men behind me will never arbitrate."

The prospect that this deadlock between the railways and their employees may be carried to the ultimate end of a general strike is so threatening that the Chamber of Commerce of the United States, representing practically all the leading commercial organizations of the country, has urged upon Congress the adoption of a joint resolution instructing the Interstate Commerce Commission to investigate at once the demands of the employees, the position of the railway companies in connection therewith, and the conditions of employment and pay of all classes of railway employees in the United States in comparison with the wages paid in other industries involving similar skill and risk.

How Can Engineering Societies Discipline Members?

A subject which is receiving a good deal of earnest attention at the present time, is the exercise of discipline in the national engineering societies. There is a general demand that the engineering societies shall exert a greater influence in the affairs of the profession than they have in the past. It is said, with reason, that membership in a national engineering society with high professional standards ought to be in itself a certificate of good character, and that if any member becomes a discredit to the profession his connection with the society should be severed.

Every one probably recognizes that an engineer of dishonesty injures not only his own reputation, but to a certain extent that of the entire profession. It is the very essence of professional work that the one undertaking it shall be faithful to the trust imposed upon him. The public will condone to a certain extent ignorance and incompetence for it recognizes that to err is human; but no excuse whatever can be made for the professional man who is false to the trust imposed upon him.

Most engineers will agree, therefore, that the member of an engineering society who is found guilty of dishonesty of any sort should be promptly expelled. Current opinion on the matter is well illustrated by the recent letter ballot in the American Society of Civil Engineers. The question asked of the members was: "The Board of Direction now elects members in all grades; shall it also have power to expel and discipline?" Of the ballots cast about 85% were affirmative.

It should be said that the constitution of the society already gives the Board of Direction power to discipline and expel members but it provides that an appeal may be taken from the action of the Board of Direction to the membership of the society which shall vote on the case by letter ballot.

It is difficult to see any justification for such an appeal. If the governing board of a society will not give enough attention to a case to decide it justly, it is difficult to believe that several thousand members, scattered all over the country, could or would obtain sufficient knowledge of the case to deal with it more wisely and justly than the board itself. Probably the recent ballot will be considered to confer upon the committee which is to revise the society's constitution authority to eliminate the clause providing for an appeal to the whole membership.

The constitution of each of the national societies empowers the governing body of the society to deal with cases of discipline to the extent of expelling a member and by inference to administer any lesser punishment such as a formal or informal reprimand. The practical question now is, to what extent are the governing bodies of these societies competent to take up this work? Of course if the discipline of members is to go no further in the future than it has in the past, that is to say, if cases of the expulsion of members are to be confined to men who have been found guilty of crime, the governing boards of the societies can doubtless continue to handle these cases as they occur. There is, however, a growing demand that the dishonest engineer, even though not criminally convicted, should be disciplined.

To one familiar with the manner in which the business of a national engineering society is carried on, it seems very doubtful whether the governing boards will be able or willing to handle these questions of discipline if they are to assume any considerable proportions. Most of the men elected to membership in the Board of Direction of the American Society of Civil Engineers, or the Council of the American Society of Mechanical Engineers, or similar governing bodies in other societies are busy men of affairs who can spend comparatively little time in attendance upon meetings, especially when, as is often the case, attendance upon meetings may mean travel of a thousand miles or more.

It will be evident that in any case where a member of a society has had charges brought against him sufficiently serious so that his conviction would mean expulsion from the society the elementary principles of justice require that he should have the right to appear in person before the board which is to pass upon his case and to present his defence with the aid of witnesses, if he desires. The constitution of the American Institute of Mining Engineers contains a clause that a member accused may appear in his own defence before the board and examine witnesses.

The governing bodies of the national engineering societies generally hold regular meetings once a month, and the meetings continue usually not more than two or three hours. It will readily be seen that in a single complicated case of discipline where it became necessary to try a member on charges, if the member should make a vigorous defence the case might occupy as much time as the governing board would require for all the rest of its year's work. Suppose half a dozen or a dozen such cases of the discipline of members were to be brought annually before a national society's governing board it is obvious that the board would be swamped and the members would adopt almost any means of shirking the task before them.

If this is a correct view of the case, it would appear that about the only practical manner in which a national society can undertake the discipline of its members on any extended scale would be to delegate the work to a judicial committee. It should be possible within the large membership of any of the national societies to find three men who have reached a time of life and a degree of success where they are no longer bound down to routine work and who have the necessary leisure combined with a willingness to use that leisure for the benefit of their profession. It goes without saying that the men should be of such standing that they would command the respect of the membership and they should be men of judicial mind so that they could deal with any case that came before them without prejudice.

There is another very important reason why discipline in a national society must almost of necessity be delegated to some such small body if it is to be exercised on any large scale. It may be necessary to exercise discipline upon members resident anywhere in the United States and even in foreign countries. Suppose, for example, charges were brought against a member resident in Galveston. It would be manifestly unjust to compel that member to travel all the way to New York City with his witnesses to present his defence; in comparatively few cases would it be possible for an accused member to go to such an expense. Of course, there are many cases in which the charges and the reply could be presented in written form on both sides and the work for the judicial committee would be comparatively easy. There is always a chance, however, that to go to the bottom of a matter it would be necessary to hold a hearing in the locality where the member resides and a judicial committee could do this, if necessary, while it would be impracticable for the twenty or more men composing the Society's governing board.

Three years ago the committee which drafted a code of ethics for the American Society of Mechanical Engineers which was later adopted by that society recognized that sooner or later disagreement would arise concerning the interpretation of that code, and so provision was made for a standing arbitration committee. It was foreseen, however, that if that committee were to hold public hearings for the examination of witnesses on opposite sides in dealing with such questions, the time consumed would make it difficult or impossible to get anyone to serve on such a committee. It was, therefore, provided that the committee should act only to arbitrate differences between any two members on the interpretation of the code, and its action should be based upon a statement in writing submitted by the disagreeing members. This plan, however, has never been carried into effect.

The above presents some of the difficulties in the way of effective discipline in the national engineering societies. It is easy to agree as to the desirability of such discipline, but very difficult to work out a practical method by which it may be exercised. Until some practical method can be devised and put in operation, the governing boards of the societies will doubtless avoid the exercise of discipline wherever they can, as they have in the past.

Letters to the Editor

Designer of Flat-Slab Floor Defends System

Sir—In the article "Extensometer Tests on Three Types of Concrete Floors," *Engineering News*, May 25, p. 992, you have unfortunately reversed the order of importance I assigned to the two causes of high stresses in the wall panels. Nowhere have I stated that the high stresses "were due mostly to the testing of the slab before it has reached its final set." In the discussion from which you abstracted your article, I referred to the misplacement of steel as "the most far-reaching one of the two conditions that obtained over the wall panels at the time of the test" and to the uncured state of the concrete as "the lesser one of two conditions that affected the wall panels."

In your editorial discussion you appear to lean toward the reasonableness of the contention that the concrete had not attained its full strength, although there is a decided difference of opinion among well informed engineers as to the extent the condition of the concrete may have affected the test, and you dismiss the incontrovertible fact of a gross misplacement of steel with the comment:

> This is a most unfortunate argument to be made by one engaged in the commercial promotion of concrete buildings. If the system of design is so delicate that construction errors by skilled if not expert workmen, foremen and engineers, honestly endeavoring to follow design, can cut in half a computed strength, the design is obviously not proper for engineering construction.

Why is it an unfortunate argument? Steel out of position is an unfortunate, yea, a deplorable, circumstance, but it is a legitimate explanation of the weakness exhibited by the wall panels. Moreover, I am not engaged in the commercial promotion of concrete buildings. I am a consulting engineer engaged in private practice without any connection with the owners or agents of a patent. In the case of the floor in the Bell Street warehouse, I selected the "Mushroom" system upon what I deemed its merits and I offer no apology for the choice.

I cannot reconcile your insinuation that the system of design used is "delicate" with my experience in construction. It may be true that the placing of steel over the interior columns is simpler than over the wall columns, but in neither is it difficult. It requires care, but care is the chief attribute in any vocation. If we are to discard care in construction we must declare 90% of all designs too delicate to be entertained. Good concrete can be made by the exercise of care despite the fact that bad concrete has been mixed by the elimination of care. The observation applies with equal force to the placing of steel reinforcement. No one is justified in asserting, because the steel in the Bell Street warehouse was misplaced, that the position of the reinforcement is not dependable in the "Mushroom" type of buildings. This is the only instance brought to my attention where steel has been misplaced in a Turner floor system. There are probably others but in no greater proportion than occur in all types of reinforced-concrete designs. They constitute unfortunate facts but should not be construed as objections to the designs.

I firmly believe you will, after further deliberation, modify your views regarding the delicate character of the Bell Street warehouse design so far as concerns its capability of erection, and you will admit that the design must not be censured because there was an error in construction.

To my mind, the two chief lessons taught by the Seattle tests are the necessity for care in inspection and the folly in denying to the designer any authority over erection. A dual responsibility should be avoided.

A. O. Powell.

Central Building, Seattle, Wash., June 3, 1916.

[We apologize for the use of "commercial," although the word was not used with derogatory intent. Capt. Powell's discussion included correspondence by representatives of a commercial system (by that meaning a system the subject of barter and sale) which accounts for the confusion.

As to the latter part of Capt. Powell's criticism we can only say that the whole case hinges on what is due "care." The Seattle authorities claim that experts were employed in the warehouse construction although they were not the employees of the designer or of the promoter of the particular system used. Misplaced steel is so common in reinforced-concrete work that many types of design have special precautions to prevent it. A system which permits experts honestly trying to follow design so to disarrange the reinforcement as to cut strength in half lacks something of perfection.

In his last contention, Capt. Powell has our complete agreement. The design of an engineering structure implies its supervision. Anything else is highly undesirable—Editor.]

Deep-Well Propeller Pump with Direct Pumping

Sir—I noticed with considerable interest an article in your issue of June 1, 1916, p. 1088, describing the deep-well pumping system at Memphis, Tenn. It is said that Mr. Wills, the designer and inventor of this system, has obtained a patent on a combination propeller and turbine pump. I also read your comment on his claims and a reference to previous publications on systems of this kind. That Mr. Wills has developed and put into operation a system of this sort is very interesting to me, for the reason that in 1903 I invented a similar pump and had a drawing of it made. It was a combination of the turbine pump manufactured by the Byron-Jackson Co. and the propeller pump manufactured by P. K. Wood. In the summer of 1903 I read at the Municipal League Convention held at Appleton, Wis., a paper on "Pumping Plants for Small Cities," which was published in *The Municipality* for December, 1903. I quote from page 96 of that publication:

None of the pumps so far manufactured are capable of lifting large quantities of water from a comparatively small well and forcing it up into the elevated tank or standpipe, except when the well will supply the pump under ordinary suction or the pump is placed in a pit.

It has been the writer's desire to secure such a pump, if possible, to take large quantities of water from wells and raise it into the elevated tank or standpipe, so as to avoid the additional expense of pits, surface reservoirs and service pumps. The Jackson compound centrifugal pump will work against a pressure of over 100 lb., while the P. K. Wood propeller pump, with certain modifications, will serve nicely for raising the water from the well to the surface.

The writer has conceived the idea of combining these two pumps together upon one shaft so as to raise the water with one pump directly to the standpipe or reservoir. The guides of the Wood pump would be modified and the general mode of construction improved upon. A 1,000,000-gal. pump of this type could be manufactured and placed in a proper well for about $2,000 and a 1,500,000-gal. pump for $2,500. With such a type of pump it would be possible to secure supplies for many of our Wisconsin cities that at the present time are short of water or are using water of inferior quality.

If proper arrangements can be made for the manufacture of these pumps, I am satisfied that they will revolutionize the water-supply problems of this state and others where there are artesian areas. With this type of pump it would be possible to put the wells as far apart as desired and operate a number of these pumps by electric motors from a central power station.

By this plan it would make it possible to secure artesian supplies for many cities of this state, of 20,000 population and over, at a very reasonable figure as compared with the cost of sinking shafts, intermediate reservoirs and two sets of pumps.

Besides this previous design and conception of such an installation there are pumps of this type made by the Indiana Pump Co., and several of them have been sold and are in operation in Wisconsin. The American Well Works, of Aurora, Ill., has such a plant in operation at Rockford, Ill. I cannot exactly see how the Patent Office could have overlooked the previous design and conception of such an outfit and granted Mr. Wills his patent. However, I am glad to know that such a system is being used extensively; and as intimated in my article of 13 years ago, I hope other cities will make use of it.

Madison, Wis., June 7, 1916. W. G. KIRCHOFFER.

Oklahoma City Water-Supply Projects, 1910 and 1916

Sir—On May 20, 1916, the people of Oklahoma City voted more than two to one for the adoption of the same plan of water-supply for the city the development and advocacy of which five years ago nearly cost the writer his life, due to the prejudice created by the circulation, by those holding high state office, of statements like the following:

By all means vote against the bonds Tuesday and protect your loved ones from this infamous scheme to dam up a big pond of deadly disease germs.

These New York engineers may give us liquid sewage at $1,250,000, and then they may retire to their beautiful homes on the banks of the Hudson River and drink from their own pure water-supply, but we will be left behind to bear the burdens and care for the dying and bury the dead and some of us are quite as much interested in protecting the health and lives of the citizens of Oklahoma City as are certain engineers in making a per cent. on a million and a quarter of our money.

I am perfectly willing, personally, and I am a taxpayer, to pay $20 a year for 40 years for clean wholesome water, but not one cent have I for sewage and filth and while I live it shall be over my protest that any engineer, for any amount of money, be permitted to feed liquid sewage to the helpless poor.

I thought of the typhoid epidemics in El Reno, the smallpox cases and social diseases which infect every city. I thought of the sewage from these sick bodies being treated by chemicals and then given to the mouths of our helpless poor to drink.

The facts in connection with the submission of the proposition at that time were clearly set forth in your issue of Mar. 2, 1911, and your editorial comment upon the situation was very much to the point.

Since that time, engineering commission after engineering commission has tried unsuccessfully to secure the adoption of every conceivable plan other than the one rejected at that time.

So bitter, however, was the feeling engendered five years ago by the interference of state officials in the affairs of the city that even at this late date in the campaign that has recently ended successfully for an additional water-supply, those advocating the water bonds were forced to declare that the plan presented was not the Potter plan. An examination of the plan submitted by the writer in 1910 and the plan upon which a favorable vote was recently secured is convincing proof that the present plan and the one advocated five years ago are one and the same, with the exception that the plan proposed by the writer included a method of water treatment in addition to that of simple storage to reduce the permanent hardness with which the waters of the North Canadian are highly charged. ALEXANDER POTTER.

50 Church St., New York City, May 26, 1916.

Subaqueous Tunnel Records

Sir—Referring to the article in your issue of June 1, entitled "Subaqueous Tunnel Record," in which it is stated that claims have been made that the progress in driving the Dorchester Rapid Transit tunnels under the Fort Point Channel, Boston, Mass., established a record for subaqueous tunnel driving, I beg to call your attention to the following records of progress made in constructing the tunnels under the North River for the Pennsylvania R.R. and Hudson & Manhattan R.R.; Charles M. Jacobs, of this firm, being chief engineer for both projects.

The best progress made on the North River tunnels of the Pennsylvania R.R. was in the month of June, 1906, when the North tunnel, driving from Manhattan, made 545.2 ft.

On the Hudson & Manhattan tunnels, the best progress was as follows: North tunnel, Downtown System—the progress for 3 mo., from Apr. 30, 1906, to July 31, 1906, was 2,321.5 ft. The best progress for a month was in this tunnel, in July, 1906, when 967.5 ft. was made.

The best progress for a week was in the South tunnel, from Aug. 8 to 15, 1906, when 308 ft. was constructed. The best progress for one day was on Aug. 1, 1906, when 36 rings, two feet long, were erected, making 72 ft. of tunnel for the day.

Conditions are so different in various localities that no comparison that means anything can be made. In the case of tunneling in the Hudson River silt in the vicinity of New York, the tunnels were advanced by forcing the shield through the silt without any excavating in advance of the diaphragm, and by only admitting through the shield doors a small portion of the material displaced by the shield.

Perhaps a fairer comparison of work accomplished would be had on the basis of volume of material removed or displaced in constructing a tunnel in a given time.

JACOBS & DAVIES, INC.,
George D. Snyder, Director.

30 Church St., New York City, June 6, 1916.

Location Survey Methods for Irrigation Canals

Sir—After reading the article under the above caption (*Engineering News,* May 25, 1916, p. 997) I am constrained to say with Solomon: "Verily, there is nothing new under the sun." As far back as 1877, while connected with the Pittsburgh Southern R.R.—a narrow-gage line between Pittsburgh and Washington, Penn.—I used the identical method, described in the article, in locating the line in crossing three summits.

A preliminary survey was first made of the line between Castle Shannon and Wrights Farm, Penn., a distance of about 14 mi., and the plan was to plot this line, project the paper location and run it on the ground in the usual way.

The work had been let and the contractors were waiting to begin operations. It then occurred to the writer to plot only the "summit" portions, project a few curves and let it go at that.

These "summit" crossings were then run in, only a few hundred feet on each side, and as the grades were 3%, grade contour lines corresponding to this grade were run in on the ground with chain and level, setting stakes 50 ft. apart, anywhere from 500 to 1,500 ft. or more ahead. Proper curves and tangents were then run in to fit the grade contours, curves up to 16° and more being used.

The writer got so accustomed to this work that it only required a look at the staked line to tell almost immediately the proper curvature to use. Of course no compensation was used as the summit crossings were nearly "all curves" and it would have been a refinement to have done so.

The line on the remainder of the railway was run in by the "practical eye," and the methods used saved several months. A portion of this old railway is used by the Baltimore & Ohio R.R. for its Western division.

Buffalo, N. Y., May 27, 1916. EMILE LOW.

Credit for Novel Power Plant

Sir—I have read the article appearing on page 740 of the April 20, 1916, issue of *Engineering News,* "Impulse Wheels Developed for Silt-Laden Water," by J. W. Swaren. In reading this article carefully, I find that it might seem to give the credit for the design of this most interesting power plant, to the Pelton Water Wheel Co. This is not correct, however, and I sincerely trust that you will publish this letter in an early issue, to correct any misapprehension that may exist.

The original conception to use, in this power plant, Pelton wheels operating on vertical shafts, was the work of O. H. Ensign, at that time Chief Electrical Engineer of the United States Reclamation Service. Mr. Ensign, against much opposition, determined on the plan of using Pelton wheels with vertical shafts in place of pressure turbines in this plant, owing to the unfavorable characteristics of the water. Mr. Ensign also worked out all of the complex details of reinforcing that entered into the construction of the plant.

The plan of using Pelton wheels was submitted to the Pelton Water Wheel Co., and their part in the plan consisted in working out the engineering details to adapt a Pelton type of wheel to this particular service, also working out the details for governing control and mechanical structure.

I appreciate that the great success of this plant reflects credit not only on the Pelton Water Wheel Co., which executed the contract, but on Mr. Ensign for his conception of the general plan and the execution of the details of reinforcing. Further than this, it was Mr. Ensign who proposed the very ingenious method of producing a load on the plant by reversing one unit operating as a synchronous motor, with the water projected against the buckets, producing a hydraulic brake and an ideal means for providing load to a hydro-electric unit. There is an error on page 744, second column, the end of line 4; namely, the water strikes *within the bowls of the buckets* as in normal use, and not on the backs of the buckets. This system of providing a load for testing purposes on the hydro-electric plant is ideal, most ingenious, and why it has not been used before it is impossible to explain. In carrying out many important tests, I have entirely overlooked the possibilities of reversing the water wheel and converting it into a water brake, and I have constructed elaborate and expensive rheostats which are more or less uncertain and unsatisfactory, whereas, with the water brake developed by rotating the wheel in the reverse direction and against the impinging jet, Mr. Ensign produces a water brake that can be controlled to the utmost degree in securing an absolutely uniform load for testing.

The Pelton Company would therefore appreciate your publishing these facts so that Mr. Ensign, now Consulting Engineer to the United States Reclamation Service, will receive proper credit for this work, inclusive of this system of testing. W. A. DOBLE,

Chief Engineer, Pelton Water Wheel Co.

San Francisco, Calif., June 10, 1916.

Wanted: Names of Engineers Experienced in Concrete

Sir—The Portland Cement Association is endeavoring to compile a list of names and addresses of engineers specializing in concrete design and construction, for the following purposes:

1. To use in replying to requests for names and addresses of men competent to (a) Design a structure; (b) pass upon a design; (c) report upon a project; (d) report upon a failure.

2. To enable us to give to parties who ask for assistance the names of specialists, for we do not encroach upon the field of men in practice.

3. To enable us to give to specialists in concrete work the names and addresses of parties in their own and nearby cities who are contemplating building and who may be induced to use concrete.

PORTLAND CEMENT ASSOCIATION,
By Ernest McCullough,
Chief Engineer Fireproof Construction Bureau.
111 West Washington St., Chicago, June 13, 1916.

To Clean a Brick Water-Supply Conduit, a city official in charge wishes to make use of mechanically operated brushes mounted on a moving car. The conduit is 5½x6 ft. in cross-section and 4½ mi. long and its inner walls are covered with silt, mixed with more or less slimy vegetable matter. This covering can be removed by hand brushes, but information regarding something cheaper and more expeditious is desired.

Washout at Abutment Drops Train from Bridge

A washout at the Flood Creek bridge on the Chicago, Rock Island & Pacific Ry., at Packard, Iowa, early in the morning of June 2, caused a train wreck and the loss of 13 lives.

A heavy storm occurred in the night, and the water was very high when the train crossed the bridge. The engine, tender, mail car and baggage car crossed in safety. The smoking car was derailed as it approached the bridge and evidently bunched the ties and tore up the guard rails, but did not go off the structure, though it swung round at an angle to the track. The day car went over into the water and was swung round by the current. The rear car (a Pullman) remained on the bank, with its front end over the first span.

The bridge (built in 1896) had three deck-girder spans of 42 ft. The abutments were of stone masonry, with footings in the bank and having no wing walls. The piers were of peculiar construction. Pile foundations carried concrete footings 4 ft. deep, of natural cement, finished with a stone coping. The original intention was to put steel bents on these copings, but instead brick piers were built, about 12½ ft. high, 21 in. thick in the lower portion, but widening at the top for the bridge seat.

The immediate cause of the accident is believed to have been a washing out of the fill just behind the abutment, as the engineman reported feeling a drop at this point. He attributed this to the dropping of the abutment, but in that case it is not likely that the engine and first cars could have crossed in safety.

When the smoking car reached this point, the drop was evidently sufficient to derail it, and it was pulled

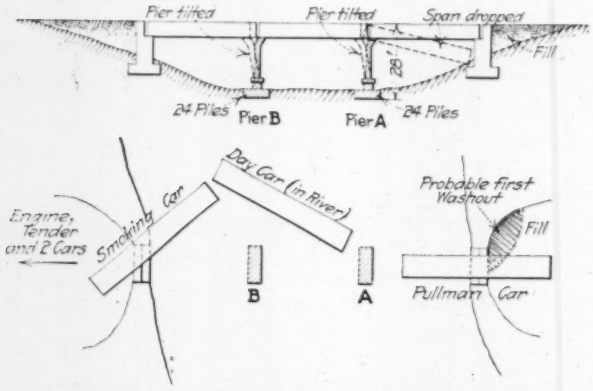


FIG. 1. LAYOUT OF THE WRECK ON ROCK ISLAND RY.

across the bridge, smashing and tearing up the deck and bending the laterals. When it reached the far abutment, it was stopped by the heap of ties it had bunched in front of it. As it stopped, it swung round, throwing the end of the next car off the bridge. The guard timbers were secured by hook bolts in every third tie and were boxed out over the ties. There were no inside guard rails.

The pounding of the engine and cars at the low point drove the entire superstructure forward about 3 ft., with the piers in an inclined position. The abutment was washed out and the end of the first span dropped, but it is believed that this happened at the end rather than at the beginning of the accident.

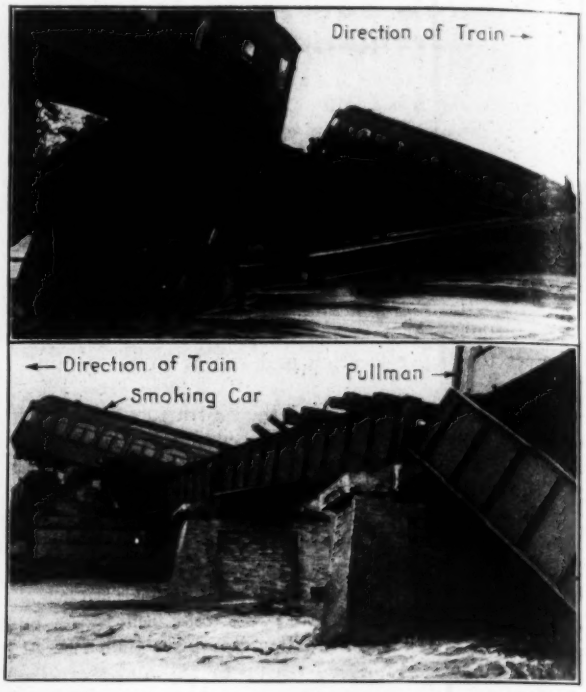


FIG. 2. VIEWS TAKEN AFTER THE RAILWAY ACCIDENT AT PACKARD, IOWA

Owing to the reports of high water at various places, a work train was sent out about half an hour before the passenger train. A stop was made at the Flood Creek bridge, but there was no sign of failure; and as the stream had caused no trouble since the bridge was built, no trouble was expected. Probably at that time the backlash from the strong current was already cutting into the fill behind the abutment, but below the water surface.

After the accident the middle span was removed by wrecking cars. Pier *A* then fell, but pier *B* seems to have returned nearly to its original position.

The upper view (on the upstream side of the bridge) shows at the left the Pullman car spanning the gap over the fallen girders of the first span, and with its truck dropped upon the girders. This was the rear car of the train. In the stream, with the rear end swung under the second span is the day coach, in which all the casualties occurred. Beyond the third span and on the bank is the smoking car, thrown across the track. This was the first car derailed. It jumped the track as it entered the bridge and tore up the floor as it ran across.

The lower view (on the downstream side) shows the two brick piers leaning forward, and torn from the coping (submerged) of the masonry base. The corbelling of the upper part of the piers is indicated, but the arched openings provided for on the plans were evidently omitted and the center wall of each pier built up solid.

Fighting City Smoke Nuisance—The Civic and Commerce Association of Minneapolis has adopted a unique plan to contend with the smoke nuisance. It will issue a "Smoke Manual," a booklet setting forth the city smoke ordinances and information relating to smoke prevention as evolved by the best engineering talent. A daily check will be kept of building permits, and prospective builders of factories and office buildings will be sent a copy of the booklet.

Boston Tech Opens New Home

The Massachusetts Institute of Technology celebrated last week its 50th anniversary and also the completion of the new buildings which it is to occupy with the opening of the new college year. These new buildings, which have been under construction for the past three years, are far more spacious than those of any other engineering educational institution in the world. They have been described in *Engineering News* at various stages in their progress. The accompanying (Fig. 2) presents for the first time a view of the completed buildings. It is somewhat inaccurate to say completed, however, for, although not shown in the photograph, the tops of derricks and concrete hoisting towers still in operation at the rear of the buildings betray the fact that work is still in progress. It is so far advanced, however, that the unfinished portions will doubtless be ready for use by the time the students assemble in the fall. It may be added that the removal of apparatus from the old buildings in Boston to the new quarters has been in progress for months, and a considerable part of the laboratory equipment is already in position. A detailed study of the ground plan of the buildings and ground, shown in Fig. 1, together with the general view from the Charles River in Fig. 2, will make clear to the reader what is still more evident from a personal examination of the buildings—that the group of buildings are remarkable both for their architectural dignity and for their adaptation to the needs of a school of engineering. The central architectural feature of the buildings is the great dome,[1] 120 ft. in span and nearly 150 ft. above the ground. The buildings that flank it on either side cover so wide an area and the dome itself, at the rear of the great central court, is so far back from the wings which front on the river esplanade that one does not realize its size and height. The double row of massive columns on the portico in front of the dome is a splendid architectural embellishment of the central court. In most buildings of classic architecture the failure to admit sufficient light to the interior is a constant trial to those who occupy the building. In the New Technology the architect has boldly met this problem by filling the spaces between the huge pilasters that form the walls of the building entirely with glass.

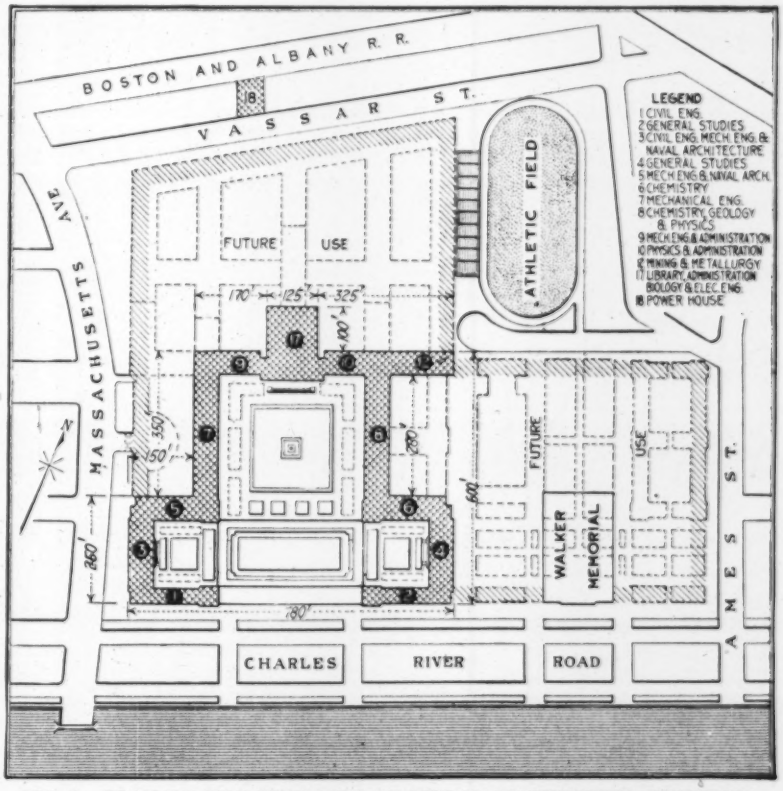


FIG. 1. PLAN OF THE NEW SITE OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

As may be seen by reference to the general plan, the buildings are of comparatively narrow width, and as they receive light from both sides through this abundant window space, there should be ample illumination at all seasons, even with the overcast skies of Boston. Artificial light, heat, etc., will be furnished to the entire group of buildings from a power house situated some 600 ft. north from the central dome adjacent to the Boston & Albany R.R. tracks. The stack of the power house may be seen in Fig. 2.

The distribution of the different departments in the group of buildings is shown by the inscriptions in Fig. 2. The buildings are three and four stories in height, and in general the laboratories occupy the lower floors and the drafting rooms the top floor, where additional light is afforded by skylights.

When it was first decided to build an entirely new Technology, a prominent engineer, who is also an alumnus of the Institute, prepared at his own expense an elaborate plan for a single great building of many stories in which to house the Institute. While this plan was not adopted as a whole, one feature of it has been incorporated in the present buildings. That is, the entire group of buildings is under one roof so that in bad weather the students need not go out of doors in passing from one exercise to another.

The entire tract owned by the Institute contains about 50 acres, so that, as may be seen from plan (Fig. 1), there is ample room for the Institute to expand its facilities. The only other building at present planned, however, is the Walker Memorial, the cornerstone for which was laid last week. This building is to contain a gymnasium, a students' club, general dining room, dormitory facilities, etc.

Of no small interest in connection with the New Technology is the remarkable manner in which it has been financed. The Institute, like every other great and rapidly growing educational institution, has required all its

[1] "Engineering News," Aug. 20, 1915.

available funds for its running expenses and had no money with which to erect a new plant suited to its needs. While the land which its old buildings occupy in the heart of Boston should eventually yield a large sum, that resource was not immediately available nor was it practicable to use for the new buildings the money in its endowment funds or that which it will eventually receive from the McKay bequest through its coöperative agreement with Harvard University. Under these conditions the money to pay for the land at the new site was contributed by generous Boston alumni, and then President Maclaurin found somewhere a generous benefactor who has contributed the money, some $3,500,000, with which the new buildings have been erected. Only one condition has been placed upon this and that is that no one whatever, except President Maclaurin, may know the identity of the giver.

The prosperous man who builds himself a large new residence generally finds when he moves in that the running expenses of his household have materially increased. It is evident that the Institute in its new home must increase its running expenses if it is to make full use of its greatly enlarged laboratory facilities and pay salaries sufficient to secure high-grade instructors. Professor Maclaurin has therefore appealed for a large addition to the Institute's endowment funds. Again the mysterious benefactor, whom all the Institute knows as "Mr. Smith" for want of a better name, has come forward with the offer, announced at the alumni dinner on Wednesday evening, that he will give $5 to the Institute for every $3 raised by the alumni prior to Jan. 1. He has agreed to make this promise good up to a contribution of $2,500,000 on his part, so that if the alumni can raise their portion, an addition of $4,000,000 should be made to the Institute's endowment. That the alumni are likely to make good their share of the contribution appeared evident at the dinner on Wednesday evening, when gifts were announced from six of the Institute's alumni aggregating a total of $1,000,000.

After the foregoing statement it seems superfluous to add that the alumni of no engineering school in the country take a more active interest in their Alma Mater than do the men of M. I. T., and that the opportunity to celebrate at once the Institute's 50th anniversary and take part in the dedication of the New Technology brought an unprecedented number of former students back to Boston.

Of the various interesting events with which the three celebration days were full, space permits brief mention here of only the two or three most important. The pageant in connection with the removal from the old buildings to the new on Tuesday evening was a ceremony unique in college annals. The officers of the Institute assembled at the old buildings, took the great seal and charter of the Institute, which had been placed in elaborate caskets, and marched in procession down Berkeley St., to the Charles River. Here at a special landing was waiting the "Bucentaur," a reproduction of an ancient state barge, propelled by 40 rowers selected from the Institute's undergraduates. In this quaint vessel the dignitaries were conveyed to the landing in front of the new buildings. In the great central court of these buildings had been erected a grand stand seating 7,000 people. In front of the stand was a throne for Governor McCall of Massachusetts, and lesser thrones for the Mayors of Boston and Cambridge. In the arena in front of the spectators was then enacted a play in which 1,000 actors took part, the play depicting the development of civilization from original chaos to the establishment of righteousness and the liberal arts and the enthronement of education.

Dedicating the New Buildings

When the pageant was over and the audience had dispersed, a huge gang of workmen appeared and all the rest of the night there was a continuous din of hammer and sledge and saw. The next morning not a vestige was left of the huge timber structure which 7,000 people had occupied a few hours before. The entire area in the central court was cleaned and smoothed, and by the afternoon 10,000 chairs had been placed there for the audience at the dedication exercises. The speakers at these exercises besides President Maclaurin, were President Lowell of Harvard, Governor McCall, and Senator Henry Cabot Lodge.

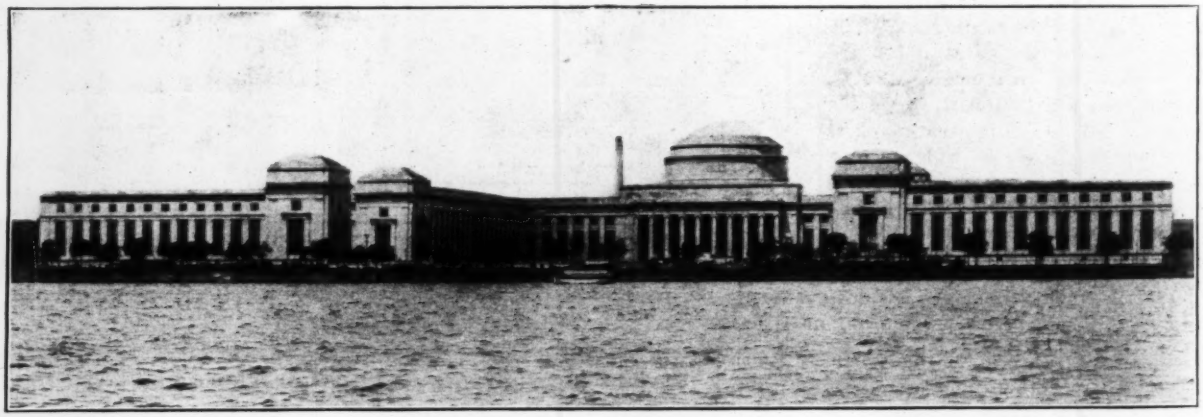


FIG. 2. NEW BUILDINGS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY FROM THE CHARLES RIVER

In view of the coöperative agreement between Harvard and Technology, the following excerpt from President Lowell's remarks is of especial interest:

The Massachusetts Institute of Technology and Harvard University have agreed to coöperate in engineering and mining education in order by so doing to render together a greater service to the public. By this spirit we have shown that we are more quick in our sense of public duty than some state institutions, which, although paid from the same treasury, maintain a needless rivalry at the public's expense.

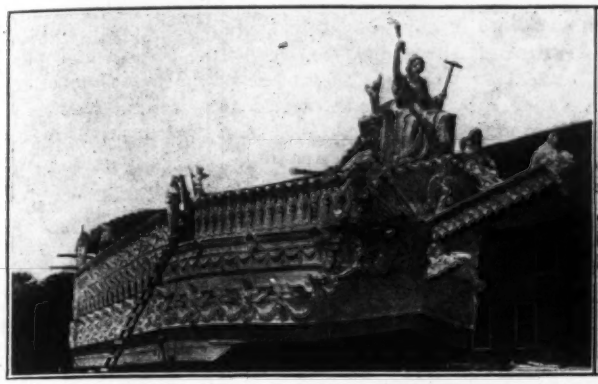
The dominant note in Governor McCall's address and also in that of Senator Lodge was that education in the technological school as well as in the university must be spiritual and not materialistic in its ultimate aim if it is to be worth while. Senator Lodge emphasized especially the duty owed by college-trained men to their country, a duty important at this particular juncture. The following brief quotations are of especial interest:

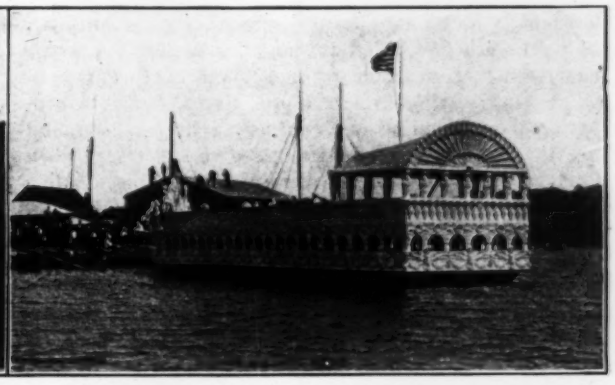
The great lesson which, to my thinking, should be learned here is that education and knowledge are not ends in themselves, but means to an end; and that one great purpose to be here achieved is to go forth with the understanding that all who have these privileges are units in the making of a nation. Our learning is vain if it fails to teach us that nations, like men, must have a conscience and a soul. . . .

We draw our blood and traditions from people and many lands, but we labor in vain if here on this soil we are aught but Americans with one country, one loyalty, and one tradition common to us all. . . . I have seen in the newspapers that the Anti-Enlistment League is preparing to circulate a pledge in our colleges and universities which runs in this wise:

I, being over 18 years of age, hereby pledge myself against enlistment as a volunteer for any military or naval service in international war, offensive or defensive, and against giving my approval to such enlistment on the part of others.

In the early days when our independence was won, in the later days when our Union was saved, such a pledge would have been described by the ugly word "treason." That anyone should now think such a pledge possible is an evil sign. People who will not make ready to defend their own peace, their own security and their own honor are well on the way to hopeless war or to supine submission.





FIGS. 3 AND 4. VIEWS OF THE "BUCENTAUR" BEFORE AND AFTER LAUNCHING

The state barge on which the officers of the Institute, bearing the charter and great seal, were conveyed across the Charles River from the old buildings of the Institute to the new

Alumni Banquets in 35 Cities Joined by Telephone

The crowning event of the celebration occurred at the alumni banquet, when the greatest feat in long-distance telephony performed was accomplished. In every place at the dinner tables in Symphony Hall, where the banquet was held, and in every chair in the galleries, there was connected a telephone receiver, some 3,000 in all. According to a prearranged plan, at the same hour at which the banqueters were assembled in Boston, there were gathered, in 35 other cities of the Union, alumni of the Institute and guests, and at each of these assemblages everyone present was provided with a regulation telephone receiver.

For two hours, from nine o'clock to eleven, Eastern time, the gatherings in every one of these cities were continuously connected. Every word spoken at the Boston dinner was heard by the diners in the 35 other cities, including such remote points as New Orleans, Los Angeles, San Francisco, Seattle, Spokane and Anaconda.

As the telephone connection was established, the toastmaster, Charles A. Stone, placed the exercises in charge of John J. Carty, President of the American Institute of Electrical Engineers and Chief Engineer of the American Telephone and Telegraph Co. Mr. Carty in turn put the telephone demonstration in the hands of A. W. Drake, of the class of '95. Mr. Drake called the roll of each of the cities in turn and received from each a reply, in which the speaker gave his own name and class, stated where the party was assembled, and the number of alumni and guests present. Every city responded as promptly when its name was called as though the speakers answering were seated at an adjacent table. Of course these conversations were heard through the telephone receivers not only by the audience of 3,000 at Boston, but by all those listening at the receivers at the dinners held in the 35 other cities. Following this "calling of the roll," President Maclaurin addressed the alumni, and then followed addresses by Dr. Michael I. Pupin, the inventor of the loading coils which solved the difficult problem of long-distance telephone transmission; Alexander Graham Bell, the inventor of the telephone; Orville Wright, the inventor of the aëroplane; Dr. Henry N. Pritchett, President of the Carnegie Foundation and former President of the Institute; and Coleman du Pont. The diners also listened to a conversation between Professor Cross of the Institute, present at the Boston banquet, and Professor Harris J. Ryan, in San Francisco. Then President Lowell of Harvard talked with Dr. H. P. Judson, of the University of Chicago, in Chicago. The famous Tech cheer was given in unison, first by a group of cities in the North, then by a group in the South, then a group in the West, then in the East, and then by all of them together. The diners at Milwaukee then joined in singing the Stein song for the edification of all the rest. As a grand finale to the demonstration Washington sang the Star Spangled Banner, while all the cities joined in the chorus.

As is well known, the exhibition of transcontinental telephone transmission with receivers connected to all the seats at a public dinner has become fairly common, but the connection of such an enormous telephone network, enabling such a large number of people scattered in so many cities to hear everything transmitted through the circuit from any point is a feat never before accomplished. The success with which it was achieved reflects great credit upon the telephone organiz-

News of the Engineering World

Bridge or Tunnel for River Crossing at New Orleans

The question of a Mississippi River crossing at New Orleans is once more being agitated, on account of a proposition before the Louisiana legislature. A report has recently been made to the Mayor of New Orleans by the engineering firm of Ford, Bacon & Davis, comparing the economical and engineering factors surrounding the construction of a bridge over the river, which is about 2,300 ft. wide at the site selected, or a tunnel under the river. This report, which is only preliminary, states that a bridge, similar to the one suggested in the 1893 project for a crossing here, would cost $8,000,000 for a railroad line alone and $13,000,000 for full provision for railroad and vehicular traffic. The estimate on the tunnel is $5,000,000 per single-track tube, the suggestion being made that the Detroit River method would be admirably adapted for the mid-river section.

Chicago Centralizes Work of Waste Disposal

The Bureau of City Waste Disposal has been established as a part of the city government at Chicago, to handle all matters in regard to the collection and disposal of garbage and refuse. It will concentrate work and responsibilities formerly divided between the Department of Health and the Department of Public Works. Under the ordinance, the head of the Bureau will be Henry A. Allen, Mechanical Engineer in charge of the garbage plants, who retains this position. He will have entire charge of the design, construction and operation of the new reduction and incineration plants.

Flood Damage in Pennsylvania

Heavy rainfall over the entire watershed of the Susquehanna River in Pennsylvania for a period of 10 days has swollen the waters of that stream to flood stage and caused much damage. At Lawrenceville, Tioga County, several small dams broke, inundating the town to a depth of 4 ft. There were no fatalities, but to take care of sanitary conditions the State Health Department dispatched two medical officers, two sanitary engineers and a corps of health officers from nearby counties to the scene. Breaking of a main gas line between Elmira, N. Y., and Corning, N. Y., left the town without light June 17. The break has been repaired.

At Lewistown, Penn., the Juniata River reached a stage of 21.6 ft. above low water at midnight, June 18. Several earth slides blocked highways and flooded cellars, causing people to move to upper floors. Near East Waterford, Juniata County, on June 17 the swollen waters of Tuscarora Creek washed away one abutment of a small bridge on the Tuscarora Valley R.R. Three cars and a locomotive dropped into the gap; the engineer was killed and the fireman fatally injured.

On the Central division of the Pennsylvania R.R. several landslides tied up traffic. On the Renovo division a slide at Lock Haven tore up tracks for 200 yd. At Spruce Creek, a 10-ton slide derailed a fast passenger train—no casualties.

At Harrisburg, the flood crested at 16.2 ft. at 6 p.m., June 18. Work was suspended on the new Cumberland Valley R.R. bridge and carried away several sections of the temporary trestle. One man was injured in endeavoring to secure the trestle.

New School of Sanitation

A School of Hygiene and Public Health will be established in Baltimore by the Rockefeller Foundation "in connection with and as an integral part of Johns Hopkins University." The central feature of the school, which it is expected will be opened in October, 1917, will be an Institute of Hygiene. A building will be erected near the University hospital. To house various laboratories and departments, including those of sanitary chemistry, bacteriology, epidemiology, industrial hygiene, vital statistics, a museum and a library. Additional facilities for instruction and research will be afforded by the existing schools of medicine, engineering, social science, etc. The Director of the School will be Dr. Wm. H. Welch, Professor of Pathology at Johns Hopkins. Among the experts consulted by the Rockefeller Foundation in formulating its plans for the establishment of the School were the following engineers and sanitarians well known to the readers of *Engineering News:* D. D. Jackson, Edwin C. Jordon, Dr. M. J. Rosenau, Geo. C. Whipple and C.-E. A. Winslow. Others who were included in the conference were Dr. A. C. Abbott, formerly Chief of the Bureau of Health of Philadelphia; Dr. Herman M. Biggs, Commissioner of Health of New York State; Dr. Wm. H. Park, of the New York City Department of Health; and Doctors Simon Flexner, Victor G. Heiser, Theobald Smith and Wm. H. Welch.

San Francisco to Build Weir for Flood Prevention

By E. A. Bailey*

A contract for furnishing all materials and constructing a concrete weir, with accompanying highway and railway bridge structures, was awarded to Teichert & Ambrose, San Francisco, Calif., on June 10, 1916, by the City of Sacramento, the contract price being $330,640.

This structure is known as the "Sacramento Weir," and is a portion of the Sacramento Flood Control Project, reported on in 1910 by the California Débris Commission of Federal Engineers (House Document No. 81, 62nd Congress, 1st Session).

*Flood Control Engineer, State Reclamation Board, Sacramento, Calif.

In the absence of appropriations by the State and Federal Governments for the construction of this weir, the City of Sacramento, being most vitally interested in its construction, voted bonds in 1912 for that purpose, as well as for the construction of the Sacramento Bypass. This bypass is 1¾ mi. long and leads from the weir to the proposed Yolo Bypass in Yolo Basin in order to relieve the Sacramento River of its excess flood waters, which are due to the addition of the flood waters of its tributary, the American River, immediately above the City of Sacramento. As later investigations have shown, these flood waters combined may reach a total quantity of 298,000 sec.-ft., or 2.7 times as much as could be carried by the Sacramento River channel, averaging 750 ft. in width, past and below the City of Sacramento.

The later investigation referred to resulted in an enlargement of the plans for the Sacramento Bypass and Weir, and the confining of the city's funds to the construction of the weir, leaving the construction of the bypass to the State Reclamation Board, which board is now causing an assessment to be levied upon all lands to be benefited to provide funds therefor.

The weir, as now planned and approved by the Chief of Engineers, United States Army, is to be 2,000 ft. in length between abutments, with its permanent sill at El. 25 (practically the elevation of the natural river bank before the levee, which is to be removed, was built at this point), but with a removable crest at El. 31, different panels of which can be either tripped by hand or automatically by floats, as the water rises to successive stages, all being open for the maximum flood discharge of 188,000 sec.-ft. when about El. 37 is reached by the flood plane.

The removable crest is to be of the needle type, and can be replaced as soon as the water has fallen below El. 31, so as to hold as much as possible of the subsiding flood within the river channel to keep it thoroughly scoured out.

The contract for the weir includes the construction of a barge fitted with gates which can be lowered to bed of channel. If necessary, this barge can be floated into position covering the opening between any two piers of the highway and railroad bridges, which, for economy, are to be constructed in conjunction with the weir, thus cutting off the flow through any panel while the removable needles are being replaced.

This plan of providing weirs and bypasses is in direct opposition to the plans for flood control on the Mississippi River where the current recommendations are against outlets.

There are two essential points of difference in conditions which should be noted as accounting for the adoption of relief weirs for the Sacramento. First, the duration of the Sacramento floods are short, lasting but a few days, with a maximum flow of but a few hours instead of a long-continued high flow, as in the Mississippi; and second, the ratio of excess for the Sacramento is from 1.7 to 6 times the channel capacity, the channel being comparatively narrow and easily scoured, during the subsidence of a flood, by the closing of gates on the outlet weirs; while the corresponding ratio for the Mississippi is only a fraction of its channel capacity, which channel is very wide and in much greater danger of silting up from a diversion of a part of its flow.

Concrete Now Permitted for New York City Pavement

Concrete pavements may be laid in New York City under certain conditions, authorized by a resolution of the Board of Estimate and Apportionment, adopted May 26. According to the charter of the City of Greater New York, street pavements paid for wholly or in part by assessment are divided into two classes, permanent pavements and preliminary pavements. The Board of Estimate and Apportionment has the authority to place pavement types in either class. Those designated permanent pavements are the following, when laid on a base of 6 in. or more of portland-cement concrete: Stone block, wood block, 3-in. asphalt block, 3-in. sheet asphalt, vitrified brick and iron slag blocks. The pavements designated preliminary are stone block on sand foundation, 2-in. asphalt block, sheet asphalt on a 4-in. concrete foundation, bituminous concrete, bituminous macadam, and since the resolution above referred to, waterbound macadam and concrete. The latter two were adopted on request of two of the Borough highway departments, and it is a part of this resolution that these types of pavement are to be used only under conditions prescribed by the Board of Estimate and Apportionment in each particular case.

It is not the intention of the city to use either type on heavy traffic streets but only in undeveloped districts where the conditions are similiar to those on country roads.

Tugboat Shifts New Drawbridge—A recently-built steel draw over the Blackwater River at Milton, Santa Rosa County, Ala., was struck by a tugboat and knocked out of position. The span was shoved over to the edge of the pier.

A Disastrous Dust Explosion in No. 3 grain elevator of the Pennsylvania R.R. at the Canton terminal at Baltimore, Md., destroyed the structure and the 1,000,000 bu. of grain it contained, and set fire to a 700-ft. pier and two steamships. contained, and set fire to a 700-ft. pier and two steamships on June 13. The loss amounted to five lives and $2,000,000.

The Water-Power Development Bills now pending in Congress will probably be taken up and pressed for passage as soon as the appropriation bills are out of the way, according to a recent statement by Representative Adamson of Georgia, Chairman of the Committee on Interstate and Foreign Commerce. Judge Adamson has drafted a substitute for the Shields water-power bill, which was passed by the Senate.

The Cost of Making Gasoline from Fuel Oil by the Rittman process is made public in a bulletin just issued by the Bureau of Mines. The first cost of a plant with a capacity for producing 850 bbl. of gasoline per month, or 35,700 gal., is estimated at $20,000. Where fuel oil can be purchased at 50c. a barrel, the estimated cost of the gasoline produced, including interest and depreciation, is 7.8c. per gal. With fuel oil at $1 per bbl., the estimated cost of the gasoline produced is 9.74c. per gal. With fuel oil at $2.10 per bbl., the estimated cost of the gasoline produced is 13.9c. per gal.

A Coal-Handling Wharf Collapsed in Portland, Me., harbor on June 9, and wrecked a part of the handling apparatus. Several workmen who were on it at the time managed to escape uninjured because of the ample warning of collapse which was given. The 120x1,200-ft. wharf, which was comparatively new, consisted of a central fill with granite retaining walls on timber piles. It carried at the shore end bins containing about 10,000 tons of coal and along one side a substantial timber trestle with cable railway connecting to the outer end of the wharf. There was also another trestle carrying two unloaders. The timber piles penetrated a soft clay stratum some 80 or 90 ft. deep but did not go through it to the hard sand beneath. The immediate cause of the collapse was apparently the racking of the wharf by a large steamship which collided with the corner of the wharf during a heavy gale. The piles carrying the nearby trestle tipped to a batter of 1 to 4 and the piers carrying the unloader trestle subsided noticeably. One of the unloaders was wrecked and a large part of the wharf wall slid into the dock.

Engineers Are to Manage a Club in New York City—The Automobile Club of America has retained the J. G. White Management Corporation to operate and manage the club house, which extends from 54th to 55th St., west of Broadway. The club operates garages, testing laboratories, machine shops, a supply department, an efficiency bureau and a bureau of tours, and issues various publications. All these are to be in charge of the Management Corporation.

Elimination of Toll Bridges spanning the Delaware River between Pennsylvania and New Jersey is being considered by two commissions representing the two states. The first meeting of the Pennsylvania commission was held at the Capitol, Harrisburg, Penn., on June 13, when Willis Whited, Engineer of Bridges for the Pennsylvania State Highway Department, was designated to coöperate with an engineer to be named by the New Jersey commission in ascertaining the value of the 16 bridges under consideration. These engineers will report at a joint meeting to be held later in the summer.

Seventeen Flood-Prevention Reservoirs on the drainage areas of the Allegheny and Monongahela Rivers in Pennsylvania, Maryland and West Virginia at an ultimate cost of $20,000,000 were discussed at a conference between Governor Brumbaugh, of Pennsylvania, and representatives of the City of Pittsburgh, Allegheny County and the Flood Commission of Pittsburgh on June 16. Governor Brumbaugh asked the delegates to send him drafts of a bill designed to bring about coöperation between all the authorities whose aid in the enterprise must be enlisted. In the delegation were N. S. Sprague, E. K. Morse and Morris Knowles.

PERSONALS

Charles E. Hewes, City Engineer of Alhambra, Calif., has been made City Manager also.

Andrew F. Macallum, M. Can. Soc. C. E., recently City Engineer of Hamilton, Ont., has been made Commissioner of Public Works of Ottawa, Ont.

Frank C. Worbs has been appointed Assistant Engineer of the Wheeling & Lake Erie R.R., succeeding E. U. Smith, with headquarters at Cleveland, Ohio.

M. M. Marsh has been appointed Superintendent of Ways and Bridges of the Northern Railway Co. of Costa Rica, with headquarters at Siquirres, Costa Rica, C. A.

Henry A. Allen, Mechanical Engineer in charge of the municipal garbage-disposal plant at Chicago, has been made head of the new Bureau of Waste Disposal.

J. O. Halliday, recently Assistant to the General Manager of the New York, New Haven & Hartford R.R., New Haven, Conn., has been appointed Superintendent of Transportation.

Samuel Rea, M. Am. Soc. C. E., President of the Pennsylvania R.R., was awarded the honorary degree of Doctor of Science at the recent commencement at Princeton University.

B. H. Klyce and **Walter J. Kackley,** Assoc. M.'s Am. Soc. C. E., announce the formation of the firm of Klyce & Kackley, Civil and Consulting Engineers, Nashville, Tenn., and Miami, Fla.

C. F. Herington, recently Assistant Engineer in the office of the Mechanical Engineer of the New York Central Lines, is now Mechanical Engineer of the Powdered Coal Department of the Bonnot Co., Canton, Ohio.

Theodore E. Wells, formerly with the engineering bureau of the Pennsylvania State Health Department, is now associated with Farley Gannett, Assoc. M. Am. Soc. C. E., Consulting Engineer, Harrisburg, Penn.

Mortimer L. Meinken, of Brooklyn, N. Y., has been awarded the $100 prize offered by the Barber Asphalt Paving Co. to students of the highway-engineering course at Columbia University for the best essay on roadwork.

Frederick W. Lindars has been appointed to the newly created office of Chief of Accounts of the Public Service Commission, First District, New York. For several years he was with the Bureau of Municipal Research, New York City.

T. C. Mitchell, Junior Engineer, United States Engineer Office, Great Bridge, Va., has been appointed by the Department of State to represent the Liberian Government on the Franco-Liberian Boundary Commission and will leave shortly for Liberia.

Waldemar Lindgren, M. Am. Inst. M. E., Professor of Economic Geology, Massachusetts Institute of Technology, formerly Chief Geologist of the United States Geological Survey, has been awarded the honorary degree of Doctor of Science by Princeton University.

William von Phul, M. Am. Soc. C. E., of Ford, Bacon & Davis, Consulting Engineers, New York City, has been appointed Vice-President and General Manager of the United Railroads, San Francisco, Calif. He is a graduate of Tulane University, Louisiana, and has been associated with Ford, Bacon & Davis since 1907.

William C. Gorgas, Surgeon-General, U. S. A., sailed recently from New York to inspect South American ports. General Gorgas goes as the head of the Yellow Fever Commission of the International Health Board of the Rockefeller Foundation. He has been granted four months' leave of absence from the army.

S. L. Strickler, of Columbia, Penn., has become associated with Farley Gannett, Assoc. M. Am. Soc. C. E., Consulting Engineer, Harrisburg, Penn. Mr. Strickler will have charge of engineering on the new Susquehanna River dam at York, Penn., for the York Haven Water and Power Co. He was formerly Assistant Engineer with F. H. Shaw and with the Pennsylvania and Wabash railroads.

Clifford Shoemaker, former Deputy Highway Commissioner of Construction of the Ohio State Highway Department, and R. C. Watts, also of the Ohio State Highway Department, have formed the Engineering Service Co., Columbus, Ohio. The new firm will take contracts in railroad, highway and municipal construction work. Mr. Shoemaker is Manager and Mr. Watts is General Superintendent.

E. W. Moir, M. Am. Soc. C. E., formerly a partner of S. Pearson & Son, Ltd., London, England, and well known in this country in connection with the Pearson company's work in the construction of the Hudson and East River tunnels of the Pennsylvania R.R., has been made a baronet in recognition of his services to the British Empire. Mr. Moir is at present in this country representing the Ministry of Munitions.

Edmund Blake, whose appointment as Engineer on the construction of the new dry dock at Boston, Mass., for the Holbrook, Cabot & Rollins Corporation was noted in these columns of May 11, was never connected with the Arrowrock dam as stated. Mr. Blake was Manager of the Idaho Irrigation Co. at Boise. The Arrowrock dam was built under the immediate direction of Charles H. Paul, Construction Engineer. James Munn was Superintendent of Construction. A. B. Mayhew was principal engineering assistant.

J. C. Hutchins, M. Am. Soc. C. E., has resigned as President of the Detroit United Ry. and has been elected Chairman of the Board of Directors. His early experience was in railway construction with the Missouri, Gulf & Lexington R.R. and other Southwestern lines. In 1894 he was elected Secretary and Treasurer of the Detroit Citizens' Street Ry. He subsequently held the same office with the Detroit United Ry., later being promoted to the position of Vice-President and General Manager, and in 1902 to the presidency of the company, which under his administration has become a system comprising 800 mi. of electric railway.

OBITUARY

Jared G. Yarnell, a retired railway contractor of Reading, Penn., died June 16, aged 76 years. For a number of years he was with the bridge department of the Lehigh Valley R.R.

Hamilton Flood, civil engineer and contractor, died at the City Hospital, Quincy, Mass., on May 23, at 46 years of age. Mr. Flood was the first City Engineer of Quincy, being appointed to the office when it was established in 1902. After serving in that capacity for six years, he went into contracting.

Silvanus P. Thompson, Past-President of the Institution of Electrical Engineers, died at his home in London, England, June 13. He was born in York, June 19, 1851. He was educated at Bootham School at York, Flounders' Institute and the Royal School of Mines. For many years he was Professor of Physics in the City and Guilds Technical College, Finsbury. He was chiefly known as the author of some of the earliest works on electrical engineering.

George Gilmour, M. Am. Soc. M. E., Chief Engineer of the Travelers Insurance Co. of Hartford, died at his home in New York City, June 15, aged 51 years. He was born in

Petrograd, Russia, where his father was engaged as Naval Constructor for the Russian Government. He was educated in Russia and in England, and his early experience was in marine engineering. Previous to his work with the Travelers Insurance Co. he was Mechanical Engineer with the New York Telephone Co. Mr. Gilmour was a trustee and member of the executive committee of the Museum of Safety and in recent years had established a reputation as an expert in accident prevention and industrial safety. He is survived by a widow.

Charles Hopkins Cartlidge, Bridge Engineer of the Chicago, Burlington & Quincy R.R., died of pneumonia, June 14, after a very short illness. He was born at Hannibal, Mo., in 1869 and after a public-school education graduated from the high school at St. Joseph, Mo. His engineering career commenced in 1886, when he went to the Kansas City, Memphis & Birmingham R.R. as rodman. He was with that road for two years and then (in 1889) became county surveyor for Buchanan County, Missouri. In 1890 he entered the service of the Chicago, Burlington & Quincy R.R. as draftsman in the bridge department and remained with that road until his death. In 1902 he was appointed Bridge Engineer and was in charge of all bridge design and construction, this road doing much of its bridgework with its own forces. He was largely instrumental in the introduction of the concrete trestle and in the use of separate or precast concrete slabs as self-supporting spans for trestles and track-elevation subways. His largest work was the design of the great Ohio River bridge now under construction at Metropolis, Ill. This has a double-track simple-truss channel span of 720 ft., which is the longest simple-truss span ever built and is notable for the extensive use of silicon steel in the main members. He was Chief Engineer of the Paducah & Illinois R.R., which is a subsidiary company for building the railway connection of which this bridge is the principal feature. In 1893 Mr. Cartlidge was married to Louise E. Almy, at Oak Park, Ill. His residence was at Hinsdale, Ill. He was a member of the American Society of Civil Engineers, the American Railway Engineering Association, the American Society for Testing Materials and the Western Society of Engineers.

ENGINEERING SOCIETIES

NATIONAL GAS-ENGINE ASSOCIATION.
June 27-29. Annual convention in Chicago. Secy., H. R. Brate, Lakemont, N. Y.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 27-30. Annual meeting in Pittsburgh. Secy., Charles Warren Hunt, 220 West 57th St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS.
June 27-30. Annual meeting in Atlantic City. Secy., Edgar Marburg, University of Pennsylvania, Philadelphia, Penn.

INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS.
Aug. 29-Sept. 1. Convention in Providence, R. I. Secy., James McFall, Roanoke, Va.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
Sept. 4-7. Convention in Hot Springs, Va. Asst. Secy., E. A. Baily, 360 Pearl St., Brooklyn, N. Y.

THE TRAVELING ENGINEERS' ASSOCIATION.
Sept. 5-8. Annual meeting in Chicago, Ill. Secy., W. O. Thompson, care General Offices, N. Y. C. R.R., Cleveland, Ohio.

AMERICAN FOUNDRYMEN'S ASSOCIATION.
Week of Sept. 11. Annual meeting in Cleveland, Ohio. Secy., A. O. Backert, 12th and Chestnut St., Cleveland, Ohio.

THE AMERICAN INSTITUTE OF METALS.
Week of Sept. 11. Meeting in Cleveland, Ohio. Secy., W. M. Corse, 106 Morris Ave., Buffalo, N. Y.

NATIONAL ASSOCIATION OF STATIONARY ENGINEERS.
Sept. 11-16. Convention, Minneapolis, Minn. Secy., Fred W. Raven, 417 S. Dearborn St., Chicago.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 12. Convention in Atlantic City. Secy., A. P. Dane, Reading, Mass.

RAILWAY SIGNAL ASSOCIATION.
Sept. 12-14. Convention in Mackinac Island. Secy., C. C. Rosenberg, Myers Building, Bethlehem, Penn.

ILLUMINATING ENGINEERING SOCIETY.
Sept. 18-20. Convention in Philadelphia, Penn. Asst. Secy., C. D. Fawcett, 29 West 39th St., New York, N. Y.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS.
Sept. 18-22. Convention in Chicago. Secy., W. O. Oschmann, Oliver Iron and Steel Co., Pittsburgh, Penn.

THE ROADMASTERS AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.
Sept. 19-22. Convention in New York City. Secy., P. J. McAndrews.

MICHIGAN GAS ASSOCIATION.
Sept. 21-22. Annual meeting in Detroit, Mich. Secy., Clark R. Graves, Lansing, Mich.

AMERICAN PEAT SOCIETY.
Sept. 21-23. Annual meeting in Washington, D. C. Secy., Julius Bordollo, Kingsbridge, N. Y.

THE TRACK SUPPLY ASSOCIATION.
Sept. 19-22. Convention in New York City. Secy., W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y.

RAILWAY FIRE PROTECTION ASSOCIATION.
Oct. 3-5. Convention in New York City. Secy., C. B. Edwards, Mobile & Ohio R.R., Mobile, Ala.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 9-13. Convention in Newark, N. J. Secy., Charles C. Brown, Indianapolis, Ind.

AMERICAN ELECTRIC RAILWAY ASSOCIATION.
Oct. 9-13. Convention at Atlantic City, N. J. Secy., E. B. Burritt, 8 West 40th St., New York City.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.
Oct. 17-19. Convention in New Orleans. Secy., C. A. Lichty, C. & N. W. Ry., Chicago.

AMERICAN GAS INSTITUTE.
Oct. 17-20. Annual meeting in Chicago. Secy., G. G. Ramsdell, New York, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Oct. 24-27. Convention in Cincinnati, Ohio. Secy., Prof. Selskar M. Gunn, Boston, Mass.

RAILWAY ELECTRICAL SUPPLY MANUFACTURERS ASSOCIATION.
Oct. 30-Nov. 3. Convention in Chicago. Secy., J. Scribner, care General Electric Co., Chicago.

NATIONAL ASSOCIATION OF RAILWAY COMMISSIONERS.
Nov. 14. Convention in Washington, D. C. Secy., William H. Connolly, Washington, D. C.

RAILWAY GARDENING ASSOCIATION.
Dec. 5-7. Convention in New Orleans, La. Secy., Charles E. Lowe, Pittsburgh Lower Western R.R., Sewickley, Penn.

The Cleveland Engineering Society held its annual dinner on June 13 in the main auditorium of the Chamber of Commerce building. The attendance was 310. Gustav Lindenthal, on whom was conferred honorary membership, gave the principal address, entitled "Monumental Bridges." Mr. Lindenthal, designer and builder of great bridges of which the most recent is the Hell Gate Arch, was a charter member of the Cleveland Engineering Society in 1880 and has continued his membership ever since. The address conferring honorary membership was delivered by Frank C. Osborn.

President-elect F. W. Ballard outlined a program of society and civic activity. Plans were announced by him looking toward raising a fund of $200,000 for a home for the society and for a large endowment for the library. J. H. Stratton is vice-president elect. Early in July the society will move from the fourth to the third floor of the Chamber of Commerce building where it will have quarters 40% larger. The new quarters will have provisions for an assembly room which will be used also for noonday lunches.

The second week in May was "Membership Week" during which time over three hundred new names were added to the roll of the society so that its membership now totals 1,130. Preparatory to the membership week a list was prepared of all in Cleveland having necessary qualifications to become members in one of the three grades, Active, Associate and Junior. This classified list contained about 1,800 names. Adding to that the number already in the society, it is seen that there are 2,600 eligibles in the city.

American Society of Civil Engineers—The Forty-Eighth Annual Convention will be held in Pittsburgh June 27 to 30 at the William Penn Hotel. Following precedent the summer meeting will be devoted in about equal proportions to business, golf, social events and excursions. The opening meeting will be held Tuesday, June 27 at 10 a.m., at the William Penn Hotel. Mayor Armstrong, of Pittsburgh and John A. Brashear, Past President of the American Society of Mechanical Engineers, will welcome the convention. The annual address of the President will be given by Clemens Herschel. In the afternoon session results of the vote on change of headquarters will be announced and committee reports received. There is to be a dinner-dance that night. On Wednesday, an all-day excursion will be taken, by rail up the Monongahela to Lock No. 4 and returning on the Steamer "Sunshine" past the Monongahela industrial district, of the Pittsburgh Harbor. Thursday will be devoted to visits to Pittsburgh industries, under guidance of members of the local committee. The following plants will be visited: American Bridge Co., Ambridge Plant; Baltimore and Ohio R.R., 33rd St. improvement; Duquesne and Edgar Thompson Steel Works of the U. S. Steel Corporation; H. J. Heinz Co.; The McClintic-Marshall Construction Co., Rankin Plant; National Tube Co., McKeesport; Pennsylvania Rubber Co., Jeannette; Pittsburgh Water-Filtration Plant, Aspinwall; Universal Portland Cement Co., Universal; the United States Bureau of Mines and United States Bureau of Standards. Members will be asked to register their selection from among these trips. Thursday evening the President's reception and ball will be held. Friday is to be devoted to an all-day golf tournament at the Oakmont Country Club, with an automobile trip for those not taking part. The Engineers Society of Western Pennsylvania will be hosts at a smoker in the evening.

Appliances and Materials

Forged Steel Insulator Pins

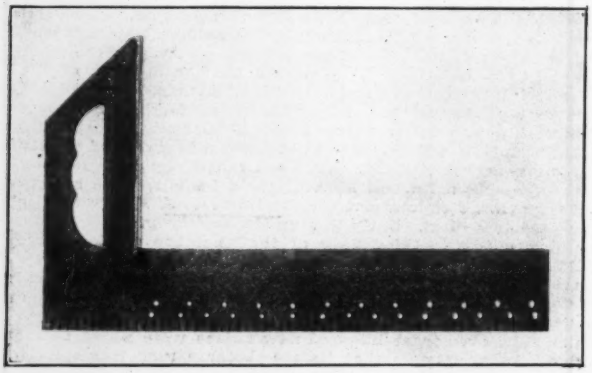
Two lines of forged-steel (open hearth) pins for transmission-line petticoat insulator pins are being made by Hubbard & Co., of Pittsburgh. One line is designed to carry a maximum of 3,000 lb. pull at the line-wire groove of the insulator; the other line is for 1,500 lb. Under such a load the pin deflection will not be more than 10° from the vertical. The bending takes place near the pin base so that the inner shell of the insulator does not break against the pin, as in the case of a cast-iron pin.

It is claimed that these pins eliminate the internal breakdown of insulators under electrical stress. A sheet-steel thimble, only $^3/_{64}$ in. thick, is cemented into the insulator, and this fits the pin loosely until a solid seat is secured by bringing up against a cork cushion in the top. This construction takes up the stress from pin expansion in the cork cushion; the small amount of metal in the thimble does not give sufficient stress in the porcelain to affect its properties, as has been thought to be the case with cast-iron thimbles.

* * *

Hole Templet for Belt Lacing

A templet square for correctly spacing holes for belt lacing, where the twisted round or wire belt lacing is used in making joints, is manufactured by the George W. Southwick



BELT-LACING TEMPLET

Co., Stamford, Conn. It is claimed to be a time saver in addition to insuring proper spacing.

* * *

Natural-Zeolite Water Softener

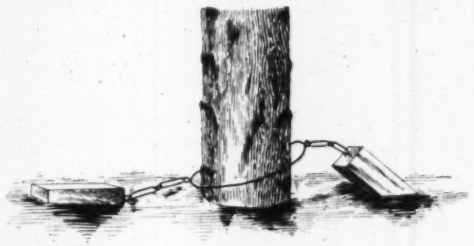
Under the trade name "Refinite," a natural mineral, zeolite, is being sold by the Des Moines Refining Co., 109 East Walnut St., Des Moines, for use in water-softening filters. The history of this development is unique. A mineral was found by a prospector in the Black Hills of Dakota, which was thought to contain fuller's earth; a sample was sent to a chemist in Des Moines, who identified it as bearing an aluminum-sodium silicate—one of the family of what are termed in geology "zeolites," having the property of easily exchanging its sodium for water-borne calcium. The chemist called in the engineers of the local water company to investigate the practicability of using the mineral in water-softening. Further studies were made by Alvord and Burdick, of Chicago, and Edward Bartow, of the University of Illinois. Finally the Des Moines Refining Co. was formed to develop the process commercially.

The use of the material is similar to that of artificial zeolites which have been found successful. The mineral is placed in a vertical cylindrical tank of such dimensions that a slow flow is secured from the top inlet to the bottom outlet. When the sodium of the mineral has been all exchanged for calcium and magnesium from the water which has been softened, a salt solution is run through and a reverse exchange effected, restoring the mineral to its original condition.

* * *

Pile Protection Against Wood Borers

The Common Sense Pile Protector Co., of Long Beach, Calif., has put on the market a novel device for keeping tidewater piles free from teredo, limnoria or other wood borers. The protector consists of a jointed metal ring or endless chain suspended about 16 in. below water level by floats attached at separated points. The protection is afforded by the combined scraping action of the wire, which has a diameter about 1 in. greater than the largest diameter of the pile, and the pounding action of the floats against the pile. These floats are so attached that they revolve on arms, rubbing and continuously striking the pile and at the same time this revolution magnifies the scraping action of the wire. A single protector will keep clean a pile from two feet below low water to high water, and a system of multiple rings is available for complete protection from high water to ocean bottom.



A SIMPLE WAY TO DESTROY TEREDOS

The protector is not sold or leased but the company contracts to give the service of protection at a yearly rate per pile. It is stated that installations on the Pacific Coast for the last four years have proved successful.

* * *

Double-Hopper Motor Dump-Wagon

The dump-wagon shown herewith consists of a pair of Lee side-dump hoppers mounted on the platform of a Knox tractor, and is intended specially for handling material on road construction. With the side-dump, material can be dumped on either side of the road, and leave a roadway through the middle of the work. As the turning radius is only 15½ ft. it can be handled and reversed very readily. With the two hoppers, material can be delivered at different points, or different materials can be carried (such as sand and stone for concrete). The hoppers are of 7½ tons capacity each, and are strengthened by interior diaphragms at the bottom. They roll on inclined paths, being kept in position by guide channels on the sides, while chains hold them at the end of their travel. As soon as the latch is released, a sharp pull on a lever is sufficient to start the hopper, whose shape is such that it gives a rapid discharge and throws the material clear of the wheels. The hoppers are of a type designed originally (in smaller sizes) for use in unloading stone, gravel, coal, etc., from railway cars. For this work they stand on steel A-frames, and are loaded by shovelers in the cars ready for

DOUBLE-HOPPER DUMP TRAILER AND TRACTOR

discharging into carts or dump wagons. They are built by the Lee Loader Co., of Chicago, which has adapted them for use on motor trucks and trailers, while the Chicago street railways have utilized them for dump cars. The motor dump-wagon illustrated was developed through the Chicago office of the Knox Motors Associates, of Springfield, Mass.

The tractor which is pivoted to the forward end of the platform, has a 40-hp. motor and can handle a 30-ton load on smooth roads. A test load of 15 tons of crushed stone was hauled over rough cobblestone paving at 16 mi. per hr., although such a speed is much too high for regular service. The first hopper being dumped, the tractor moved forward 5 ft. and dumped the second load on top of the first pile.